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A BIBLIOGRAPHIC DATABASE FOR THE HISTORY OF PILOT TRAINING SELECTION

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Sponsored by
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Strategic Research and Assessment Branch

July, 2011

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Technical Report
DAS-2011-02

A Bibliographic Database for the History of Pilot Training Selection

William R. Howse and Diane L. Damos

July 2011

Damos Aviation Services
Meeting pilot hiring needs.

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14. ABSTRACT
This report documents the development of and accumulation of a set of reference materials covering the history of U.S. aviator selection from the inception of military applied flight to the present day. It presents the materials so that they may be applied as a reference database or as a complete digital library for use by researchers in the field. The two DVDs containing the referenced material herein are maintained at AFPC/DSYX.

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A BIBLIOGRAPHIC DATABASE

FOR THE HISTORY OF PILOT TRAINING SELECTION

Introduction

In August 2009 Damos Aviation Services (DAS) accepted Subcontract TCN 09216 from Battelle Columbus Operations under the U.S. Air Force Research Office Scientific Services Program, Contract W911NF-07-D-0001 / Delivery Order 0906. This report describes and documents the bibliographic database developed and delivered as a result of that subcontract.

In previous work funded by U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) under an Army contract (DASW01-03-D-0016, Selection Instrument for Flight Training) DAS initiated a review and analysis of aviator selection in the United States and other countries which led to a technical report on aviator selection prior to 1925 (Damos, 2007). In a subsequent effort, funded by ARI under Air Force contract FA3089-06-F-0580 (Human Resources Research Database and Strategic Planning Support), DAS produced a bibliographic database of sources from WWI to the present. DAS continued to survey the literature and assemble relevant documents after completion of the original database.

Database Description

For a variety of reasons, including resource limitations, lack of interest, lack of motivation, or plain ignorance, there is a tendency today for agencies to reduce or eliminate support for the operation of small libraries and reference collections. When support is withdrawn there is often little consideration given to the preservation of such collections. The bibliographic database developed under this project preserves a large number of references and their associated files that may otherwise have been lost or destroyed. Even if the product of the present effort serves as no more than an archive it will prove valuable to future research and development.

The bibliographic database contained herein was formed by reviewing objects available in local tangible formats and records accessible through linkages on the Internet. Information from these was entered into the database through a database management software package to form records. Where possible, the full-text objects corresponding to these records were acquired and linked to their entries. Review of a large proportion of the entities provided paths to other, previously unknown entities. For remote sources where data retrieval capabilities existed (some data retrieval capability exists with nearly every Internet resource) searches were performed on all available data fields using keywords that are commonly associated with aviator selection practices.

The entries in the reference database are listed in author order in Appendix B. Note that the first 57 entries have no author listed.

Limitations. Objects entered as database records are associated with pilot selection in the United States Armed Forces from the inception of the employment of aviation by the U.S. military to the present day. There are some records that are primarily relevant to commercial aviation, military

pilot selection in other countries, and to general knowledge, skill, ability and other characteristics (KSAO) assessment for occupational or training selection. These are included because they bear close association with U.S. military pilot selection and are likely to be of use to researchers in the area. Web pages are not included for two reasons: Few are primary sources of information and most are ephemeral. That is, there is a high likelihood that a cited web page will not exist in the near future.

Sources. The entries in the database were retrieved from 46 documented sources. These are listed in Table 1 along with their Uniform Resource Locators (URL). In addition to these sources a large portion of the corpus is derived from personal holdings of the authors and from documents literally rescued from discard. A full set of the Army Air Forces Aviation Psychology Program Research Reports (commonly known as the *Blue Book*) series was retrieved by Dr. R. Bruce Gould from a dumpster at Brooks Air Force Base. A large number of documents was retrieved from the scientific reference files at the Rotary Wing Aviation Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). These were scheduled to be shredded and recycled because the building in which they were housed was transferred to another agency and no library would accept the files. Since then the remaining documents from that collection were transferred to the Redstone Scientific Information Center (RSIC) at Redstone Arsenal, AL.

Table 1. List of sources for entries in the bibliographic database.

SOURCE NAME	URL
Air Force Human Resources Laboratory	None
Air Force Publishing	https://www.my.af.mil/gcss-af/
Air University Library Index to Military Periodicals	http://www.dtic.mil/dtic/aulimp/index.html
Air University Press	http://www.maxwell.af.mil/au/aul/aupress/
American Institute of Aeronautics and Astronautics (AIAA)	http://www.aiaa.org/
American Memory	http://memory.loc.gov/ammem/browse/index.html
American Psychological Association (APA)	http://www.apa.org
Army Administrative Publications	http://www.army.mil/usapa/epubs/index.html
Army Doctrine and Training Publications	http://www.army.mil/usapa/doctrine/Active_FM.html
Army Heritage Collection Online	http://www.ahco.army.mil/site/index.jsp
Center of Military History Online Bookshelves	http://www.army.mil/cmh/online/Bookshelves/Books3.htm
Defense Technical Information Center (DTIC) Public Scientific and Technical Information Network (STINET)	http://multisearch.dtic.mil/dtic/
Damos Aviation Services	http://www.damosaviation.com
Donovan Research Library Digitized Monograph Collection	https://www.infantry.army.mil/monographs/
Electronic Code of Federal Regulations	http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=3efaad1b0a259d4e48f1150a34d1aa77
Google Books	http://www.google.com/books
Headquarters, U.S. Army Medical Command	https://www.us.army.mil/suite/portal/index.jsp
Human Factors and Ergonomics Society (HFES)	http://www.hfes.org
Ingenta	http://www.ingentaconnect.com
International Military Testing Association (IMTA)	http://www.internationalmta.org/
International Symposium on Aviation Psychology (ISAP), Association for Aviation Psychology, Proceedings	http://www.wright.edu/isap
Internet Archive	http://www.archive.org
Joint Doctrine, Education and Training Electronic Information System	https://jdeis.js.mil/
Joint Electronic Library	http://www.dtic.mil/doctrine/index.html
Library of Congress	www.loc.gov/
Library, Information Science & Technology Abstracts (LISTA)	http://www.libraryresearch.com/
Military Library Education Research Library Network (MERLN) Digital Collections	http://merln.ndu.edu/index.cfm?lang=EN&pageID=2&type=page
National Aeronautics and Space Administration (NASA) Technical Reports	http://ntrs.nasa.gov/
National Defense University Library Digital Collections	http://www.ndu.edu/Library/index.cfm?secID

	=210&pageID=126&type=section
Naval War College Newport Papers	http://www.nwc.navy.mil/press/npapers/newpaper.htm
Pentagon Library	http://www.hqda.army.mil/library/m.htm
PsychInfo	http://www.apa.org
PubMed, National Library of Medicine	http://www.ncbi.nlm.gov/pubmed/
RAND Review	http://www.rand.org/publications/randreview.html
RAND Technical Reports	http://www.rand.org/pubs.html
Scitopia	http://www.scitopia.org
U.S. Army Military History Institute (AMHI), Historical Services Division	http://www.carlisle.army.mil/ahec/MHI.htm
U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) – Fort Rucker Research Unit holdings	None
U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) Technical Library	http://arit.sirsi.net/uhtbin/cgisirsi/x/0/0/49
Web of Science	http://science.thomsonreuters.com/training/wos/
World Wide Science	http://WorldWideScience.org
WorldCat	http://worldcat.org
United States Air Force Academy	http://www.usafa.af.mil/index.asp
Aviation Technical Library, Fort Rucker, AL	http://www.rucker.army.mil/usaace/techlibrary/index.html
Navy Department Library	http://www.history.navy.mil/library/index.htm
U.S. Naval Research Laboratory Ruth H. Hooker Research Library	http://infoweb.nrl.navy.mil/index.cfm?i=157

Quantification. The database currently comprises 1,805 entries represented in 20 different object types. These object types are as follows:

Audiovisual Material
Book
Book Section
Chart or Table
Conference Paper
Conference Proceedings
Edited Book
Figure (Photograph)
Government Document
Journal Article
Legal Rule or Regulation
Magazine Article
Manuscript
Pamphlet

Personal Communication
Report
Serial
Statute
Thesis
Unpublished Work

The publication dates span a range of 149 years from 1862 to 2011. There are nine entries for which there is no known year of publication. For one entry the year of publication is known only to the nearest decade. There are 5,005 authors cited and 1,391 keywords listed. There are 57 entries that have no author listed. The database contains citations for articles from 479 journals. Ninety-three entries have associated URLs. There are two entries whose associated documents are distribution restricted (so labeled in the *Notes* attribute for those entries) although the database entries themselves are not restricted. No entries are classified or sensitive. There are 18 entries that are considered to be incomplete. These are included in a subgroup in the database management software files. There are 721 object files linked to the entries. Most of these are digitized full-text representations of the original work or digitized photographs. There are a number of instances where more than one file is linked to an entry. This is because the size of the work makes it difficult to reliably operate the scanning and interpretation software employed.

Scanning and Optical Character Recognition. There are a large number of entries for which hard copies were accessible but for which digitized copies were not. These were scanned into digitized files (Portable Document Format – pdf) and Optical Character Recognition (OCR) procedures were applied. The success level of OCR software is dependent on the quality of the image being interpreted. If the original image was degraded or noisy, then the frequency of interpretation errors is increased. There are a number of files that are scanned but OCR success was so minimal that they have been left unintepreted. The internal content of these files can not be automatically searched.

Special mention should be made of the Army Air Forces Aviation Psychology Program Research Reports (Blue Book) series. The digitized representations of these works are derived from two sources: Xerographic copies of some volumes that were in the ARI holdings and digital photographic images of volumes made by Brandon Spillers from originals possessed by the U.S. Air Force. The Xerographic copies are of mediocre quality and may be second generation copies. The scanned files are therefore at best second generation, and may be third generation copies. As such their image quality is sufficient to allow them to be read but not sufficient for successful OCR. The digitized images were made as Tagged Image File Format (TIFF) images, one for each page. These images were subsequently assembled into pdf files, however, they tend to be somewhat skewed and slightly out of focus. Therefore OCR was not successful on these.

Bibliographic Database Management Software. The software used in this project is a commercially available proprietary package named EndNote, marketed by Thompson Reuters (www.endnote.com/), Version X4. This package is designed to run under Microsoft Windows XP, Vista, and Windows 7 operating systems and under Macintosh OS X. It will interface with several word processors including Microsoft Word 2003, 2007, 2010 and OpenOffice.org Writer 3, as well as with Macintosh Pages '09. There are a number of freely distributed database

management software packages available which are available at no cost and are platform (operating system) independent. Three of these are:

Bibus	http://bibus-biblio.sourceforge.net/wiki/index.php/Main_Page
JabRef	http://jabref.sourceforge.net/
Refbase	http://www.refbase.net/index.php/Web_Reference_Database

Copyright Limitations

Copyright restrictions affect the uses to which the database may be applied. Many of the entries in the database are from sources that retain copyright. The most common are journals published by the American Psychological Association (APA). The APA Copyright and Permissions Policy (American Psychological Association, 2011) specifically asserts control over abstracts of articles published in APA journals. It would be impractical to obtain permissions to use every one of the abstracts associated with APA journal articles in the database. Therefore the APA abstracts are not present in the database files. Many of these have been replaced by newly written abstracts.

Copyright restrictions limit the redistribution (availability) of the associated digitized text files. Many of the works in the database are in the public domain, and, therefore present no problem. Government publications are by their nature in the public domain and therefore present no problem. Many others, however, do not belong to either category. It has been asserted that libraries and archives are specifically allowed to make up to three copies of a work for the purpose of preservation under the Digital Millennium Copyright Act of 1998. It has also been asserted that the Fair Use provision for individuals and libraries allows copies to be made subject to four factors: Purpose of the use, Nature of the Work, Amount used, and Market impact. The problem ensues from the fourth factor. Journal publishers may have an expectation of revenue based on the sale of reprints of articles. If one widely distributed digital copies of these works, journal publishers could argue that this distribution dilutes their market.

In this regard at least three courses of action are available. The first is to make all of the full text files unavailable for research. The second is to sort through all of the files and make only those that are copyrighted unavailable. The third is to acquire permissions to use each of the copyrighted files.

User Instructions

Disk Contents. Accompanying this report is a set of two digital video disks (DVD) that contain the complete database and related files. These two DVDs containing the referenced material herein are maintained at AFPC/DSYX. This set is the Digital Library of the History of Pilot Training Selection. On Disk A of this set an EndNote database is contained in the file Aviator Selection.enl. A co-located folder, *Aviator Selection.Data*, contains a subfolder, *PDF*. The subfolder *PDF* contains subfolders that themselves contain the file attachments associated with entries in the database. The EndNote application packages file attachments in a separate folder for each database entry. In some cases there are multiple files within a subfolder. Disk A also contains the file *Aviator Selection.htm*, which is a hypertext markup language (HTML) listing of

the complete entries in the database. This file can be read by standard internet browsers. Finally, Disk A contains a Standard Form 298 for the digital library (*sf298.doc*).

The size of the complete library exceeds the capacity of a single DVD. Therefore the balance of file attachments are on Disk B of the set, in *Aviator Selection.Data\PDF*. Disk B contains two other folders. The folder *Trash* is intended as a temporary location for deleted entries and is empty. The folder *rdb* contains 22 files that are used by the file management software. These are not intended to be manipulated by users.

Installation. Please refer to Appendix A for definitions of basic terms used here. To use these products as a digital library, with EndNote as the reference management software package, copy the entire contents of Disk A to the desired directory on a local hard drive. Then copy all of the entry-specific subfolders in *Selection.Data\PDF* on Disk B into the subfolder *Aviator Selection.Data\PDF* on the local hard drive. Assuming EndNote has been installed, the library can be opened by starting EndNote and then opening *Aviator Selection.enl* or by double clicking on *Aviator Selection.enl*.

To use these products as a bibliographic database, with EndNote as the reference management software package, copy all files as above EXCEPT for the subfiles under *Aviator Selection.Data\PDF*. Doing this eliminates access to all of the attached files for database entries (including copyrighted materials). If access to an attached file is made within EndNote, the application will issue an error message stating that the file can not be found.

Most other bibliographic database management applications can import the contents of an HTML file. This is the main reason for including the file *Aviator Selection.htm*. Most other bibliographic database management applications will not function as digital libraries, that is, they do not directly link to full-text files associated with database entries.

References

American Psychological Association. (2011). Copyright and Permissions Information. from http://www.apa.org/about/contact/copyright/index.aspx

Candela, L., Athanasopoulos, G., Castelli, D., El Raheb, K., Innocenti, P., Ioannidis, Y., et al. (2011). *The Digital Library Reference Model* (No. D3.2b): Digital Library Interoperability, Best Practices and Modelling Foundations.

Damos, D. L. (2007). *Foundations of military pilot selection systems: World War I* (Technical Report No. 1210). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Reitz, J. M. (2010). ODLIS: Online Dictionary for Library and Information Science. 2011, from http://www.abc-clio.com/ODLIS/odlis_b.aspx

Appendix A. Basic Definitions

A *bibliographic database* is ~~a~~ computer file consisting of electronic entries called records, each containing a uniform description of a specific document or bibliographic item, usually retrievable by author, title, subject heading (descriptor), or keyword(s). Some bibliographic databases are general in scope and coverage; others provide access to the literature of a specific discipline or group of disciplines. An increasing number provide the full-text of at least a portion of the sources indexed. Most bibliographic databases are proprietary, available by licensing agreement from vendors, or directly from the abstracting and indexing services that create them (Reitz, 2010).

Reference management software packages contain a bibliographic database integrated with filter, search and list generation functions. Most include the capability of generating lists of selected references in specific formats required for various publications. Many reference management packages can be interfaced with commonly available word processors so that a reference list can be produced as an article is written. This reduces the risk of cited sources being left out of the reference list or of including entries that are not cited in the text. It also can potentially reduce the frequency of typographical errors in a reference list. Reference management software packages usually have a capability to import entries from other bibliographic databases.

A *digital library* is an extension of the bibliographic database and reference management software structures that include full-text copies of the entries, stored in digital formats rather than print, microfilm, or similar media. The term Digital Library is defined by the Digital Library Interoperability, Best Practices and Modeling Foundations as ~~a~~ potentially virtual organisation, that comprehensively collects, manages and preserves for the long depth of time rich digital content, and offers to its targeted user communities specialised functionality on that content, of defined quality and according to comprehensive codified policies" (Candela et al., 2011).
A traditional library, that is, one containing directly tangible works in a range of media as opposed to digitized representations of those works, requires substantial physical space and consequently significant maintenance cost, is limited by available physical space and its operations schedule, requires significant manpower for operation, and limits access by virtue of its location and by participant group boundaries. A digital library may be made available globally through the Internet, without regard to time, allows multiple users to access works simultaneously, incurs no risk of resource loss to patrons, and provides broader and faster information retrieval facility.

Appendix B. Listing of the Bibliographic Database Entries With Abstracts

. Ground signals to an aviator. In Ground signals.pdf (Ed.), (pp. Ground signals.pdf
Collection: World War I Miscellaneous-Roy Coles Album 2
Folder: RG75S-World War I Miscellaneous Coll.-Roy Coles Album 72.28
Title: Ground Signals to an Aviator).

. Manual for the use of the Student Pilot Prediction System. Naval Air Station, Pensacola, FL: Naval Aerospace Medical Research Laboratory.

. Airfield near San Antonio. (192?) (pp. Created/Published [192-?]
Notes: Forms part of John J. Pershing Collection. Title based on similarity to panorama 193 in this lot. Photographer's address and phone number: 522 Mason St., San Antonio, Texas. Travis 5384. Transfer; LC Manuscript Division (John J. Pershing papers); 1953. Related Names: San Antonio Photo Service, photographer.
Medium: 5381 photographic print : gelatin silver ; 5389 x 5358.5385 in.
Call Number
LOT 8852 no. 5385
Special Terms of Use: No known restrictions on publication.
Part of Panoramic photographs (Library of Congress)
Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA
Digital ID: (digital file from intermediary roll film copy) pan 20546a35796
http://hdl.loc.gov/loc.pnp/pan.20546a35796).

. Fair Oaks, Va. Prof. Thaddeus S. Lowe observing the battle from his balloon "Intrepid". (1862) (pp. CREATED/PUBLISHED 1862 May 1831.
SUMMARY: Photograph from the main eastern theater of war, the Peninsular Campaign, May-August 1862.
NOTES: Reference: Civil War photographs, 1861-1865 / compiled by Hirst D. Milhollen and Donald H. Mugridge, Washington, D.C. : Library of Congress, 1977. No. 0067
Title from Milhollen and Mugridge. Two plates form left (LC-B1811-2348A) and right (LC-B1811-2348B) halves of a stereograph pair.
Forms part of Civil War glass negative collection (Library of Congress).
MEDIUM: 1861 negative (1862 plates) : glass, stereograph, wet collodion.
CALL NUMBER: LC-B1811- 2348
REPRODUCTION NUMBER:
LC-DIG-cwpb-01560 DLC (digital file from original neg. of left half)
LC-DIG-cwpb-01561 DLC (digital file from original neg. of right half)
LC-B08171-02348 DLC (b&w film copy neg.)
SPECIAL TERMS OF USE: No known restrictions on publication.
PART OF Selected Civil War photographs, 01861-01865 (Library of Congress)
REPOSITORY: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA
DIGITAL ID: (digital file from original neg. of left half) cwpb 01560
http://hdl.loc.gov/loc.pnp/cwpb.01560

(digital file from original neg. of right half) cwpb 01561 http://hdl.loc.gov/loc.pnp/cwpb.01561
(digital file from intermediary roll copy film) cwp 01564a39678).

. Annual Report of the Secretary of War for the Year 1885. Vol III: Report of the Chief of Ordnance. (1885). Washington, DC: U.S. Government Printing Office.

. Flying Machines Aero Squadron, Mobilization Camp, Texas City, 1913. (1913) (pp.
Created/Published 1913.
Notes: Copyright deposit; Joseph M. Maurer; April 1928, 1913.
Related Names
Maurer, Joseph M., 1876-1953, copyright claimant.
Medium: 1911 photographic print : gelatin silver ; 1917.1915 x 1960 in.
Call Number
PAN US MILITARY - Army no. 1919
REPRODUCTION NUMBER
LC-USZ1962-52714 DLC (b&w film copy neg. of left section made from another print)
LC-USZ52762-52715 DLC (b&w film copy neg. of center section made from another print)
LC-USZ52762-52716 DLC (b&w film copy neg. of right section made from another print)
Special Terms of Use: No known restrictions on publication.
Part of Panoramic photographs (Library of Congress)
Repository:
Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA
Digital ID
(digital file from intermediary roll film copy) pan 52716a33307
http://hdl.loc.gov/loc.pnp/pan.52716a33307).

. *Field Service Manual for Balloon Companies*. (1917). Washington, DC: Government Printing Office.

. "Making ready", U.S. Aviation Field, Fairfield, O., June 9th, 1917. (1917) (pp.
Created/Published 1917 June 1919.
Notes: Copyright claimant's address: Springfield, O. No. 1911. Copyright deposit;
Pixley-Messick Co.; June 1912, 1917.
Related Names
Pixley-Messick Co., copyright claimant, photographer.
Medium: 1911 photographic print : gelatin silver ; 1917.1915 x 1950.1915 in.
Call Number
PAN US MILITARY - Army no. 1918
Special Terms of Use: No known restrictions on publication.
Part of Panoramic photographs (Library of Congress)
Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA
Digital ID
(digital file from intermediary roll film copy) pan 20546a33296
http://hdl.loc.gov/loc.pnp/pan.20546a33296).

. Notes on Cooperation Between Aircraft and Artillery During Recent Operations on the Second

Army Front. (1917). Washington, DC: Army War College.

. Special Regulation, No. 50 Aviation Section Signal Corps. (1917). Washington, DC: Government Printing Office.

. Addendum to the Instruction on the Use of Aerial Observation in Liaison With the Artillery. (1918) (pp. 14). Washington, DC: Government Printing Office.

. Air Service Flying School, Rockwell Field, San Diego, Cal., Nov. 23, 1918. (1918) (pp.
Created/Published 1918 November 1923.
Notes: Copyright deposit; Kearny Photo Co.; December 1926, 1918.
Related Names
Kearny Photo Service, copyright claimant.
Medium: 1911 photographic print : gelatin silver ; 1917 x 1946 in.
Call Number
PAN US MILITARY - Army no. 1153
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Part of Panoramic photographs (Library of Congress)
Repository: Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA
Digital ID
(digital file from intermediary roll film copy) pan 20546a29864
http://hdl.loc.gov/loc.pnp/pan.20546a29864).

. Air Service Medical Manual. (1918). Washington, D.C.: War Department: Air Service Division of Military Aeronautics.

. *Army Mental Tests Methods, Typical Results and Practical Applications*. (1918). Washington, D.C.

. Aviation companies, Love Field, Dallas, Tex. (1918) (pp. Created/Published
c1918.
Summary: Sitters wearing their hats.
Notes: Copyright deposit; Frederick W. Hellenberg; August 1920, 1918; DLC/PP-1918:45890.
Related Names
Hellenberg, Frederick W., copyright claimant.
Medium: 45891 photographic print : gelatin silver ; 45899 x 45844.45895 in.
Call Number
PAN US MILITARY - Army no. 45155
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Part of Panoramic photographs (Library of Congress)
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http://hdl.loc.gov/loc.pnp/pan.45896a29882).

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Notes: Copyright deposit; Frederick W. Hellenberg; August 1920, 1918; DLC/PP-1918:45890.
Related Names
Hellenberg, Frederick W., copyright claimant.
Medium: 45891 photographic print : gelatin silver ; 45899 x 45841.45895 in.
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Summary: Sitters holding their hats.
Notes: Copyright deposit; Frederick W. Hellenberg; August 1920, 1918; DLC/PP-1918:45890.
Related Names
Hellenberg, Frederick W., copyright claimant.
Medium: 45891 photographic print : gelatin silver ; 45899.45895 x 45844.45895 in.
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http://hdl.loc.gov/loc.pnp/pan.45896a29890).

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Notes: Copyright deposit; Kearny Photo Service; December 1919, 1918.
Related Names
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Medium: 1911 photographic print : gelatin silver ; 1917.1915 x 1937.1915 in.
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http://hdl.loc.gov/loc.pnp/pan.20546a30540).

. U.S. Naval Air Station, San Diego, Cal. (1918) (pp. Created/Published c1918.
Notes: Copyright deposit; Kearny Photo Service; December 1927, 1918.
No. 1913.
Related Names
Kearny Photo Service, copyright claimant.
Medium: 1911 photographic print : gelatin silver ; 1917 x 1938 in.
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http://hdl.loc.gov/loc.pnp/cph.123913c123913).

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Notes: Copyright deposit; Kearny Photo Service; December 1928, 1918; DLC/PP-

1919:45967. No. N.A.S.45961.
Related Names
Kearny Photo Service, copyright claimant.
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http://hdl.loc.gov/loc.pnp/pan.45966a33091).

. "Uncle Joe" (J.F. Kerman)of the Knights of Columbus giving chocolate to Marie Chausson of La Besage. (1918). In J. Kerman.pdf (Ed.), (pp. Collection: World War I Miscellaneous - Roy Coles Album 3 Folder: RG75S-World War I Miscellaneous Coll. - Roy Coles Album 73.170 Title: 'Uncle Joe' (J.F. Kerman) of the Knights of Columbus giving chocolate to Marie Chausson of La Besage, also to another of the refugees brought in from La Besage. Most of these people were injured by bombs dropped by U.S. aviators. St. Pierrre-Mont, Ardennes, France, Nov. 177th 1918).

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Notes: Copyright deposit; Huddleston Photo Co.; January 1916, 1919; DLC/PP-1919:45907. Copyright claimant's address: Los Angeles, Cal. No. 48659.
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Related Names
Huddleston Photo Co., copyright claimant.
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. Balloons at rest, Arcadia, Cal. (1919) (pp. Created/Published
c1919.
Notes: Copyright deposit; Huddleston Photo Co.; January 1916, 1919; DLC/PP-

1919:45907. Copyright claimant's address: Los Angeles, Cal. No. 48660.
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Title derived from copyright deposit records.
Copyright deposit; Charles Louis Brenner; June 12, 1919.
Medium: 1911 photographic print : gelatin silver ; 1919.1915 x 1935.1915 in.
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PAN US MILITARY - Navy no. 1921
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Notes: Transfer; LC Manuscript Division; 1948. No. 1916. Forms part of Josephus Daniels collection. Donor information derived from the photo mounting technique.
Related Names
Wootten-Moulton (Firm), photographer.
Medium: 1911 photographic print : gelatin silver ; 1917 x 1945 in.
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Digital ID
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Copyright deposit; Boeing Airplane Co.; October 1912, 1922.
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Medium: 1921 photographic print : gelatin silver ; 1927.1925 x 1936 in.
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(digital file from color film copy slide) cph 20543f06344
http://hdl.loc.gov/loc.pnp/cph.20543f06344).

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Created/Published c1924.
Notes: Copyright deposit; R. S. Clements; December 1924, 1924.
Medium: 1921 photographic print : gelatin silver ; 1929 x 1943.1925 in.
Call Number
PAN US MILITARY - Navy no. 1922
REPRODUCTION NUMBER
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Substantial controversy exists about ability determinants of individual differences in performance during and subsequent to skill acquisition. This investigation addresses the controversy. An information-processing examination of ability-performance relations during complex task acquisition is described. Included are ability testing (including general, reasoning, spatial, perceptual speed, and perceptual/psychomotor abilities) and skill acquisition over practice on the terminal radar approach controller simulation. Results validate and extend Ackerman's (1988) theory of cognitive ability determinants of individual differences in skill acquisition. Benefits of ability component and task component analyses over global analyses of ability-skill relations are demonstrated. Implications are discussed for selection instruments to

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This article reviews theoretical approaches for distinguishing a "nonnal" from a "neurotic" motivation to fly. The purpose of this review was to develop a definition of a "healthy" motivation to fly that could aid in decisions concerning whether or not grounded pilots should be returned to duty. The authors used a dynamic perspective and noted that, in their experience, grounded pilots were usually psychologically defended and not introspective. Because pilots have difficulty in expressing their motivations to fly, the authors concluded that the examiner's sensitivity to countertransferential feelings may be the best diagnostic method. One profile of healthy pilots showed that they tended to be first-born children who had close relationships with their fathers. Other research suggests that "successful risk-takers" should be selected, while an alternative view is that conservative compulsives may be preferable in the context of most flying tasks. Research also suggests that an Oedipus syndrome may point to an unhealthy motivation to fly, because pilots may be motivated to seek success as an overcompensation for perceived inadequacies.

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Electroencephalograms taken on pilots with a history of accidents or of unconscious episodes in flight were compared with those on a Control Group of 1375 aviation candidates. Certain EEG features were found to be much more commonly recurrent in the incident-accident groups then in the Control Group. Implications of these findings are discussed with respect to

possible use of EEG as a selective device for aviators and with respect to the relationship between app rent cerebral instability and other physiologically unfavorable factors whose coincidence may trigger an unconscious episode. Recommendations for further investigation and baseline EEG recordings are made. (Author)

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This study deals with the problem of retaking identical or parallel mental ability tests. This can lead to difficulties in the assessment for prestigious jobs like pilot or ab initio pilot candidate positions, where test preparation is common and a large training industry has been established. We investigated practice effects on test-takers‘ performance and reliability as well as validity of a spatial ability task. The task was administered ten times, five minutes each, in a sample of 156 ab initio pilot applicants. A performance plateau was reached after the fifth trial, reliability and validity were not affected negatively, they even tend to rise. Consequences for diagnostics are discussed and a brief outlook on the incorporation of the spatial ability task in a multiple task performance test battery is given.

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Allnutt, M. F., & Everhart, C. D. (1980). Retraining Army Aviators Following a Protracted Absence from Flying (pp. 43). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

A group of Individual Ready Reserve (IRR) Utility Helicopter (UR-I) aviators who had not flown for several years was retrained by Army Research Institute (ARI) instructor pilots at the United States Army. Aviation Center(USAAVNC). The main emphasis of the training program was on daytime contact maneuvers, the evaluation of which was carried out by Standardization Instructor Pilots (SIPs) for USAAVNC. Conclusions are drawn about the optimum nature and content of the training program, the hours required to reach a satisfactory standard, and the relationship between the training hours required, total flying time and years away from flying.

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Ambler, R. K., Bair, J. T., & Wherry, R. J. (1960). Factorial structure and validity of naval aviator selector variables. *Aerospace Medicine, 31*(6), 456-461.

This study assessed the effectiveness of the Navy's Aviation Score Sheet for selecting flight trainees. The Aviation Score Sheet consists of a total score and seven component scores: (1) a personality rating (composed of ratings on five traits, which are assigned by a senior naval officer [traits were not mentioned]); (2) the Aviation Qualification Test (AQT; cognitive ability); (3) the Flight Aptitude Rating (FAR; attitudes); (4) the Selection Board Rating (SBR); (5) past scholastic performance; (6) credit hours in math and physics and (7) the board evaluation. Specifically, the validity of the Aviation Score Sheet for predicting a variety of criteria was examined. Four criteria were used: pre-flight ground grade (GG), pre-flight Officer-like qualities (OLQ), flight failure (FF) and voluntary attrition (VA). The personality rating correlated significantly with GG (r = . 11) and VA (r = -. 12). The AQT correlated significantly with GG (r = .44) and OLQ (r = .12). The FAR correlated significantly with all four criteria, validities ranged from .11 for OLQ to .43 for FF (median =.30). Neither the selection board rating nor the board evaluation were significantly related to any of the criteria. Past scholastic performance predicted GG (r = .21) and OLQ (r = .15). Finally, credit hours in math and physics were significantly correlated with GG. These seven Aviation Score Sheet component scores were also factor analyzed, along with the four criteria and a variety of other selection measures (rotation method unspecified). Five factors were retained and labeled: (1) flight ability; (2) appearance of maturity; (3) military conduct; (4) motivation to take risks; and (5) academic interest.

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This study investigated the validity of a Brief Vestibular Disorientation Test (BVDT) for predicting various pi lot training criteria. FINDINGS Test scores were evaluated for their relation to three criteria: 1) students separated from flight training for all causes versus completions; 2) tension and/or airsick separations versus all others; and 3) airsick separations versus all others. Results showed significant relationships between high sensitivity scores on the BVDT and membership in the various separation groups. The airsick separation group had the highest mean BVDT sensitivity score. Statistical evidence indicates that the BVDT ratings tap a significant portion of the flight criterion variance not reached by the present prediction methods.

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A Brief Vestibular Disorientation Test (BVDT) was developed that involves observer

assessment of subjects' reactions produced by head movements in a rotating chair. Reliability of observers has been demonstrated, and significant validation and cross-validation coefficients have been reported for criteria of pass versus various types of separations from pilot training. It has also been established that the BVDT score significantly augmented the multiple correlation of existing aviation selection variables with the same criteria. The purpose of this study was to determine if reliability, validity, and augmentation of correlation could be obtained with less disturbance to the subject than that caused by the 15-rpm speed of rotation used thus far in the BVDT. Reduced disturbance and aftereffects are desired because the BVDT is now envisioned as becoming part of the entering flight physical, and procedures that might either impair performance on the other tests or require recovery periods must be held to a minimum. The BVDT procedure used here was identical to two previous studies except that a speed of 10-rpm was used instead of 15-rpm. Subjects were 157 flight students who were tested within the first four days of reporting for training. Retesting of 72 of the subjects was conducted 9 weeks later. The test-retest and rater reliability coefficients obtained were not quite so high as for those who had the 15-rpm procedure, but they were of acceptable magnitude. The validity coefficients were approximately the same as those obtained for 15-rpm, and significant augmentation of the existing selection battery and cost effectiveness was demonstrated. It was concluded, therefore, that the 10-rpm BVDT was a feasible procedure. It was also concluded that, because the mean score for the 10-rpm group was lower than the mean for either of the two 15-rpm groups used previously, subject disturbance had been reduced.

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Past research has demonstrated the value of the Brief Vestibular Disorientation Test (BVDT) as a screening tool for student pilots. This study is concerned with the extension of this technique for use in assessing the potential Naval Flight Officer (NFO). The rater BVDT procedure was used here, and in addition, a performance task involving a short- term memory task in the auditory mode was introduced in order to measure performance decrement. Representative groups of entering NFO students were first administered the performance task under the exact conditions of the previous BVDT procedure, but without rotation. After a 2-minute rest period, the procedure was repeated with rotation. Observer assessments were made during this rotation sequence. The results indicate that those students who later failed NFO training exhibited greater performance decrement under rotary conditions as compared to static than did successful students. Rater-type BVDT scores also indicated slightly greater sensitivity (.07 level of significance) to the vestibular stimulus for the failures than for the successes. It was concluded that this technique is of value in screening NFO's.

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Ambler, R. K., Rickus, G. M., & Booth, R. F. (1970). Prevention of misassignments among various aviation specialties. *Aerospace Medicine, 41*, 15-17.

Ambler, R. K., & Smith, M. J. (1974). Differentiating aptitude factors among current aviation specialities. Pensacola, FL: Naval Aeromedical Research Laboratory.

These researchers created a special criterion measure reflecting training success for a sample of1700 Navy aviation trainees in three pilot and four non-pilot Air Force specialties. They then factor analyzed several personality and cognitive ability measures along with several different criterion measures, in order to determine which of these tests to include in a selection and classification battery. These measures included the Guilford-Zimmerman Aptitude Survey, the Hidden Figures test and four tests from the Navy and Marine Corps aviation selection battery (including a biographical inventory). An initial factor analysis of the predictors alone yielded six factors: mechanical, spatial manipulation, perceptual flexibility, verbal intelligence, numerical intelligence and flight motivation. Other factor analyses were then conducted which included various combinations of the predictor measures and selected criterion measures (a pilot/non-pilot dichotomous variable, a training completed attrition dichotomous variable and the special criterion measure of training success). Several principal axis factor solutions were examined. The most salient results included relatively weak loadings for verbal intelligence across all criteria, greater utility of numerical intelligence for non-pilot versus pilot specialties and large loadings for flight motivation across all criterion combinations. Based on these results, the authors suggest reducing the emphasis on the verbal intelligence component in selection and further exploring the construct of flight motivation.

American Institutes for Research. (1950). *A report of progress on the first steps in the development of a procedure for measuring the proficiency of private pilots report of an incomplete survey conducted under the sponsorship of the Committee on Aviation Psychology, National Research Councils with funds from the Division of Research, Civil Aeronautics Administration*. Pittsburgh,.

Ames, V. C., & Older, H. J. (1948). Aviation psychology in the United States Navy. *Review of Educational Research, 18*, 532-542.

Amos, C. (2007). Warrants with wings. *Navy Times, 56*(19), 4.

The article reports on the applications being taken by the U.S. Navy from second- and first-class petty officers and chiefs for its aviation chief warrant officer (CWO) selection board through the Flying CWO Program. The pilots and flight officer that will tap the program will undergo warrant officer indoctrination before starting flight school.

Anastasi, A., & Foley, F. P. (1952). Psychiatric selection of flying personnel: The Human Figure Drawing Test as an objective screening for student pilots. Randolph AFB, TX: School of Aviation Medicine.

Anastasi, A., Foley, J. P., & Sackman, H. (1954). Psychiatric screening of flying personnel: An empirical evaluation of the SAM personality-sketch test. Brooks Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Anderson, H. G. (1917). Some medical aspects of aviation. *Journal of the Royal Naval Medical Service, III*, 328-331.

Anderson, H. G. (1918). Aeroplane accidents. *Journal of the Royal Naval Medical Service*, 51-68.

Anderson, H. G. (1919). *The Medical and Surgical Aspects of Aviation*. London: Henry Frowde Hodder & Stoughton.

Anderson, H. R., & Povenmire, H. K. (1976). *Total testing in Coast Guard aviation training*. Paper presented at the 18th Annual Military Testing Association Conference, Gulf Shores, AL.

Andrews, D. H., & O'Neil, H. F. (Eds.). (2000). *Aircrew Training and Assessment*. Mawhah, NJ: Lawrence Erlbaum Associates.

Anesgart, M., & Callister, J. D. (1999). *Predicting training success with the NEO: The use of logistic regression to determine the odds of completing a pilot's screening program*. Paper presented at the 10th International Symposium on Aviation Psychology, Columbus, OH.

AF screening program. ROTC program grads. Predict only SIEs, not flight training deficiencies

Anesgart, M. N., & Callister, J. D. (2001). Predicting Training Success with the NEO-PI-R: The Use of Logistic Regression to Determine the Odds of Completing a Pilot Screening Program (pp. 18). Wright-Patterson AFB, OH: United States Air Force Research Laboratory.

Antonof, G. S., Domogala, M. C., & Olson, W. A. (2007). *Operating an unmanned aerial system from a moving platform*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

While the Spatial Disorientation (SD) has long been recognized as an important causal factor in aviation incidents and accidents, it is only beginning to be recognized as a factor in Uninhabited Aerial Systems (UASs). Self, Ercoline, Olson and Tvaryanas (2006) predicted SD to be most likely for a manually controlled UAV when operated from a mobile platform. As a first step towards better understanding the effects of control platform motion on manual UAV control Olson, DeLauer and Fale (2006) had 10 rated Air Force pilots fly a simulated UAV task (MS Flight Simulator) from a motion capable control platform (aircraft simulator). Participants performed two basic flight tasks – a vertical task (climb/descent) and a horizontal (turning task). The control platform motion was varied to provide either congruent, neutral, or conflicting motion cues. Congruent and incongruent motion cures were defined as motion in the same axis and either same/different direction as the primary task (i.e., simulator turned left/right and task was a constant left hand turn). Neutral motion was defined as motion in a different axis of motion relative to the primary task (i.e., simulator motion was climb/descent and task was a constant bank turn). There were three levels of visual and vestibular control platform motion cues (no motion/visual cues, motion with no outside visual display, motion with outside visual). The results indicate that there was little effect of control platform motion on roll axis performance, i.e., bank and heading error. However, pitch axis deviations (altitude and vertical velocity) showed an effect of both control platform motion and motion type. Presence of both

visual and motion cues resulted in greater pitch deviations than motion only or baseline (no motion/no visual cue) conditions and the presence of motion in the off-axis of motion resulted in the greatest error. These results suggest that platform motion may interfere with an operator‘s ability to manually control a UAV from a moving platform (a possible precursor to SD). The current study replicates the simulator study using an aircraft (C-172) as the control platform. This will allow for a more complete examination of platform motion cues since simulators cannot adequately simulate sustained motion. This study also adds a landing task to examine glide path and azimuth error. Data collection is not yet complete, however initial results indicate that, as in the previous simulator study, control platform motion resulted in greatest interference in the vertical axis and the presence of both motion and visual cues resulted in the greatest control interference. These results have implications for planned UAV operations from both fighter and transport aircraft.

ARCO. Specimen Navy and Marine Corps Aviation. Selection Battery *Military Flight Aptitude Tests*: ARCO.

Armstrong, H. G. (1943). *Principles and Practice of Aviation Medicine* (Second ed.). Baltimore, MD: The Williams & Wilkins Company.

Armstrong, H. G. (1948). U.S.A.F. developments in the selection and classification of fliers. *Military Surgeon, 102*, 469-473.

Arnold, R. D., & Phillips, J. B. (2008). Causes of Student Attrition in US Naval Aviation Training: A Five Year Review from FY 2003 to FY 2007 (pp. 17). Pensacola, FL: Naval Aerospace Medical Research Laboratory.

A review of self-reported causes of Naval Aviation student training attrition was conducted for the period FY 2003 to FY 2007. Data were aggregated from Naval Aerospace Medical Institute attrition reports published during the period under review. Drop on Request (DOR) was the single greatest self-reported administrative reason for attrition during this five-year period, accounting for 40% of attrition among survey respondents. Performance related attrition was 37% of all attrition, with flight failure the most frequent cause in this category, at 24% of all attrition. Self-reported contributory factors were also examined. Survey response options related to anxiety and nervousness related to flying and to the flight program were among the most frequently endorsed contributing factors. Among other frequently endorsed factors were poor flight performance, loss/change of interest, and motion sickness. To reduce training attrition, recommendations are made for S&T investments in aviation personnel selection research to identify valid predictors of anxiety, fearfulness, task prioritization, motivation, and motion sickness susceptibility.

ARRO. (1982). Evaluation of the validity for the mission track assignment battery: Task analysis survey for the attack mission. Washington, DC: Advanced Research Resources Organization.

Arth, T. O. (1984). *Validation of the Air Force Officer Qualifying Test*. Paper presented at the 26th Annual Military Testing Association Conference, Munich, West Germany.

Arth, T. O. (1985). *Which Air Force candidates benefit most from retesting?* . Paper presented at the 93rd Annual Conference of the American Psychological Association, Los Angeles, CA.

Arth, T. O. (1986). Air Force Officer Qualifying Test (AFOQT): Retesting effects. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Arth, T. O. (1986). Validation of the AFOQT for non-rated officers. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

This study showed the validity of the Air Force Officer Qualifying Test (AFOQT) by comparing its composites with performance in non-rated technical training courses (TTCs) . Pearson product-moment correlations were computed among the five AFOQT composite scores and the final school grade earned by 9,029 Air Force officers attended 37 separate TTCs . The results revealed positive and significant correlations, especially in the initial courses . Regression analyses were then run to determine the optimal weighting of the existing composites that best predicted training success . Future research will analyze subtest data in order to form composites for each TTC.

Arth, T. O., & Skinner, M. J. (1986). *Aptitude selectors for Air Force officers non-aircrew jobs*. Paper presented at the 28th Annual Military Testing Association Conference, New London, CT.

Arth, T. O., Steuck, K. W., Sorrentino, C. T., & Burke, E. F. (1990). Air Force Officer Qualifying Test (AFOQT) Predictors of Undergraduate Pilot Training and Undergraduate Navigator Training Success. Brooks AFB TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

This research investigated the relationship between the Air Force Officer Qualifying Test (AFOQT) Form O and performance (pass/fail) in Undergraduate Pilot Training and Undergraduate Navigator Training. It was found that the several subtests and composites currently being used in the pilot and navigator selection had significant correlations with pilot and navigator training success, respectively. When the correlations were corrected for restriction in range, the correlations increased moderately. Regression analysis revealed that the AFOQT has greater accuracy in predicting success in UPT and UNT when two distinct composites are used than when one combined composite is used. The evaluation of the potential composites against the existing composites revealed that several alternative composites were more effective in predicting pilot and navigator training success than those currently in operational use.

Ashman, A., & Telfer, R. (1983). Personality profiles of pilots. *Aviation, Space, and Environmental Medicine, 54(10)*, 940-943.

Samples of Air Force fighter pilots, trainee commercial pilots, and males drawn from the general community completed the Edwards Personality Preference Schedule (EPPS). Four significant effects were found for individual sub-scales; three (Achievement, Affiliation, and Nurturance) identifying air force fighter pilots. Commercial pilot trainees scored significantly less than the community sample on Succorance and Nurturance. The data suggest that the EPPS consists of several related personality dimensions. One of these, "sociability," discriminated fighter pilots from the general community.

Askren, W. B. (1966). A preliminary evaluation of a short psychomotor test. Pensacola, FL: U.S. Naval Aerospace Medical Institute.

The General Vehicular Research Trainer, developed by the U.S. Naval Training Device Center, Port Washington , New York, has been loaned to the Naval Aerospace Medical Institute for evaluation as a selection device. The purpose of this preliminary study was to determine the suitability of one particular aspect of the device as a test that might have some potential as a predictor of success in Naval aviation training. FINDINGS The accumulated error scores from using a control stick to reset a linear indicator were used as the performance measure. A series of twelve thirty-second trials was found to provide adequate reliability and variability , and to be possible of administration within practical time limits.

AVCSA. (1975). An Abridged History of the Army Attack Helicopter Program. Washington, DC: Office of the Assistant Vice Chief of Staff of the Army.

Aviation Rulemaking Advisory Committee. (1998). *ARAC Pilot Selection Survey*. committee report.

Azoy, A. (1934). Estudio psicofisiolÃ´gico de la profesiÃ´n de piloto aviador. *Revista de Psicologia i Pedagogia, 2*, 54-79.

Describes test content, scoring methodology and graphic presentation techniques for an aptitude battery administered at the Catalonian Psychotechnical Institute. Indicates that there is a wide range of variation among successful applicants in temperament. Selection criteria are based on measures of perception and motor ability. Ability to control emotional reactions is important. Method of Limits is used to analyze responses which are presented on bar diagrams. Acceptance decision is a subjective evaluation of the overall profile of scores on all tests as well as other subjective behavioral evaluations.

Bacon, G. (1907). *The Record of an Aeronaut*. London: John Long.

Baden-Powell, B. (1908). *Ballooning as a Sport*. Edinburgh: William Blackwood and Sons.

Baer, L. H. (1973). Learning center evaluation, Volume I Measurement of students' attitudes toward undergraduate pilot training, learning centers. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Bailey, M. (1999). *Evolution of aptitude testing in the RAF*. Paper presented at the RTO HFM Workshop on Officer Selection, Monterey, CA.

This paper outlines the history of the RAF aptitude test system and the changes made to aptitude test development programmes and testing policies which have been driven by technological and psychological advances and the requirements to assess for different specialisations and be cost effective. Consideration is also given to the next generation of aptitude tests.

Bair, J. (1952). The characteristics of the wanted and unwanted pilot in training and combat. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Bair, J. (1952). Non-test predictors of attrition in Naval air training command program. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Bair, J., & Hollander, E. P. (1953). Studies in motivation of student aviators at the Naval School of Aviation Medicine. *Journal of Aviation Medicine, 24*, 514-517; 522.

Bair, J., Lockman, R., & Martoccia, C. T. (1954). A factor analysis of predictor and criterion variables for the Naval air training program. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Bair, J., Lockman, R., & Martoccia, C. T. (1960). Validity and factor analysis of Naval air training predictors and criteria measures. *Journal of Applied Psychology, 40*, 213-219.

Bair, J., & Maag, C. H. (1953). Attitude toward entering training as predictors of motivation among student aviators. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Bair, J. T. (1952). The characteristics of the wanted and unwanted pilot in training and in combat. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Bair, J. T. (1954). A short attitude scale and its relation to motivation in the Naval Air Training Program. Pensacola, FL: Naval Aerospace Medical Institute.

Bair, J. T., & Ambler, R. K. (1954). Attrition data as a criterion II. Attitudes of flight failures toward leaving training. Pensacola , FL: Naval Aerospace Medical Institute.

Bair, J. T., & Ambler, R. K. (1955). Attrition data as a criterion III. Medical attrition with anxiety symptoms. Pensacola , FL: Naval Aerospace Medical Institute.

Bair, J. T., Lockman, R. F., & Martoccia, C. T. (1956). Validity and factor analyses of naval air training predictor and criterion measurers. *Journal of Applied Psychology, 40*(4), 213-219.

The most substantial relationships existed between tests of academic aptitude and grades in the pre-flight phase of training. Tests of spatial and perceptual abilities correlated highest with final basic and advanced flight grades. Four significant factors derived by factor analysis were: perceptual, academic potential, comprehension of relationships, and applied spatial relations [these factors, however, accounted for only 51 percent of the total variance]. Although the inclusion of criterion variables did not reveal any new factors, it did aid considerably in defining those factors found.

Baitsell, G. A. (Ed.). (1945). *Science in progress; Fourth series.* New Haven: Yale University Press.

Baisden, A. G. (1976). *Research on the aeronautical adaptability of women*. Paper presented at the 18th Annual Military Testing Association Conference, Gulf Shores, AL.

Although women have had some visibility in aviation for many decades, their

participation beyond clerical, stewardess or the private pilot level is still perceived as novel. Military aviation has been opened to women on a basis of career parity with men. The motivation behind this is twofold: 1) response to the influences of current cultural and legal demands for equality of opportunity for women, and 2) the prospect of an enlarged person-power base from which future personnel needs of an all-volunteer force can be filled. This expanded opportunity placed a burden on the behavioral and life sciences to: (1) examine the role of women in aviation, (2) take stock of existing knowledge, (3) define areas of true differences or commonality with respect to the existing male aviation population, (4) identify problem areas, and (5) seek solutions. This overview will attempt to integrate certain existing knowledge and current Navy research concerning women in aviation. The specific topics to be addressed cover attitude, aptitude, performance, and human factors considerations. The anthropometric problems related to the aeronautical adaptability of women which are discussed include: (1) design requirements for flight safety, emergency egress and operator comfort, and (2) strength requirements related to aircraft flight control. Other research efforts discussed are (1) the measurement of attitudes of Navy and Marine Corps aviation personnel toward women on several factors, including their acceptance into aviation training, (2) the assessment of the female‘s ability to handle multiple complex tasks under stress, and (3) the effects of the menstrual cycle on complex perceptual-psychomotor tasks.

Baisden, A. G. (1980). A comparison of college background, pipeline assignment, and performance in aviation training for black student naval flight officers and white student naval flight officers. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Baisden, A. G. (1980). *An examination of Black accession and performance in Naval aviation training*. Paper presented at the 22nd Annual Military Testing Association Conference, Toronto, Ontario.

Baisden, A. G. (1988). *Retaking the U.S. Navy and Marine Corps Aviation Selection Test Battery*. Paper presented at the 30th Annual Military Testing Association Conference, Arlington, VA.

It has been recognized informally that an increasing number of recent training failures, particularly minority students, had taken the aviation selection test several times before qualifying. This study assesses retake performance on the aviation selection test battery, analyzes test performance by 'race/ethnic groups, and examines retest effects on predicting success in aviation training.

Baisden, A. G., & Doll, R. E. (1978). A comparison of black student performance and white student performance in naval aviation training. Naval Air Station Pensacola, FL: Naval Aerospace Medical Laboratory.

Baisden, A. G., & Doll, R. E. (1979). A comparison of college background , pipeline assignment, and performance in aviation training for black student naval aviators and white student naval aviators. Naval Air Station Pensacola, FL: Naval Aerospace Medical Laboratory.

Bale, R. M., & Ambler, R. K. (1970). The application of college and flight background questionnaires as supplementary noncognitive measures for use in selection of student naval aviators. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

The need for supplementary noncognitive background information in the selection of naval aviation students has become Increasingly evident. Recent exit Interviews with student pilots who have voluntarily withdrawn from training Indicate that factors unrelated to mental ability (such as attitude toward the military) often entered into their decision. This study was conducted to determine if Inclusion of the noncognitive items of the college and flight background questionnaire would enhance the validity of the existing primary selection process, thus reducing the current attrition rate. Certain items of the college and flight background questionnaires, when coupled with the residual validity of the existing selection tests, were found to increase the predictive validity of the current selection system. The prediction equation developed on half of the sample was successfully cross validated with the remaining half. implementation of the suggested technique would have reduced the attrition rate by 4.5 percentage points in the cross-validation sample. Thus, it was recommended that this technique be incorporated as a management tool at the primary selection level.

Bale, R. M., & Ambler, R. K. (1971). Application of college and flight background questionnaires as supplementary noncognitive measures for use in the selection of student naval aviators. *Aerospace Medicine, 42*, 1178-1181.

These researchers conducted exit interviews with naval aviation students who had voluntarily withdrawn from flight training and found that the reasons students withdrew were often unrelated to mental or physical ability. Accordingly, this study examined the effectiveness of two background questionnaires, the College Background Questionnaire (CBQ) and the Flight Background Questionnaire (FBQ), in decreasing the attrition rate and thus improving the cost effectiveness of naval flight training. The CBQ is comprised of questions about applicants' college experiences (e.g., number of times college major changed, type of school attended). The FBQ is comprised of questions about applicants' experiences with flying (e.g., actual flight experience, experience as an airline passenger). A total of 22 items from both inventories were included in this study. Subjects were 1207 aviation officer candidates who entered flight training during 1966 and 1967. Of this sample, 769 completed training and 438 attrited for various reasons. The sample was split in half to create an initial validation sample and a cross-validation sample. Two multiple regressions were conducted in the validation sample to predict training completion. The first regression used the four selection tests currently used by the Navy (i.e., the Aviation Qualification Test, the Mechanical Comprehension Test, the Spatial Apperception Test and the Biographical Inventory) and the second included the CBQ and FBQ items as well. Regression weights generated using the validation sample were then applied to the cross validation sample to generate predicted criterion scores. These scores correlated .19 with actual training completion/attrition. A cut-off score was then selected to eliminate a maximum number of attrites while allowing for the retention of the greatest number of "completes." Using this cutoff score in the cross-validation sample, the inventory would have eliminated 34 percent of the attrites, at the expense of only eliminating 16 percent of the completes.

Bale, R. M., Rickus, G. M., & Ambler, R. K. (1970). Replacement air group performance as a criterion for naval aviation training. Naval Air Station Pensacola, FL: Naval Aeromedical Research Laboratory.

Bale, R. M., Rickus, G. M., & Ambler, R. K. (1972). Factor analysis of undergraduate and postgraduate flight training grades. *Aerospace Medicine, 43*, 373-375.

Bale, R. M., Rickus, G. M., & Ambler, R. K. (1973). Prediction of advanced level aviation performance criteria from early training and selection variables. *Journal of Applied Psychology, 58*(3), 347-350.

The criterion of success versus failure in undergraduate flight training has permitted cost effective estimates of the probability of an applicant or student completing naval flight training. However, a prediction problem remains for some designated aviators who are not successful in the replacement air group (RAG) , or postgraduate, phase of instruction. This study employed multiple correlation analysis to examine RAG completion as a remote criterion variable. Undergraduate training grades significantly predicted RAG completion. Had the obtained regression weights been employed, the attrition rate of a cross- validation sample would have been reduced by 33.8%. Those skills in under- graduate training that are "mission oriented" as opposed to academic or flight skills contributed the most to the explained criterion variance.

Bale, R. M., Smith, M. J., & Ambler, R. K. (1972). Factor analysis of undergraduate and postgraduate flight training grades. *Aerospace Medicine, 43*, 372-375.

Bale, R. M., & Waldeisen, L. E. (1969). The relationship of the Objectively Scoreable Apperception Test (OAT) to success in Naval aviation. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Bangs, K. (2004). Pilots who shouldn't be. *Business and Commercial Aviation, 95,* 46-51.

Banich, M., Stokes, A., & Elledge, V. (1989). Neuropsychological screening of aviators: A review. *Aviation, Space, and Environmental Medicine, 60(4)*, 361-366.

The Federal Aviation Administration (FAA) is currently investigating the possibility of including a mini-mental status exam as part of the Aviation Medical Exam. We review evidence that if such a policy is to be implemented, present mental status tests are likely to be inadequate for the job for two reasons. First, they are likely to tap a level of cognitive ability below that required for proficient piloting and second, they may not tap some cognitive skills that are relevant to aviation. We suggest that a new mini-mental status test comprised of already existing neuropsychological tests could be devised that would overcome these difficulties.

Barbour, A. B., & Whittingham, H. E. (Eds.). (1962). *Human Problems of Supersonic and Hypersonic Flight*. London: Pergamon.

Barlow, E. (1968). Abstracts of personnel research reports: VIII. 1954-1968. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Barnes, J. (1999, Fall, 1999). Pilot Hiring. *The Leading Edge,* 24-28.

Barnes, M. J., Knapp, B. G., Tillman, B. W., Walters, B. A., & Velicki, D. (2000). Crew systems analysis of unmanned aerial vehicle (UAV) future job and tasking environments (pp. 65). Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.

The purpose of the research project was to understand the future crew environments for developing unmanned aerial vehicle (UAV) systems. A variety of human engineering tools Gob assessment software system [JASS], enhanced computer-aided testing [ECAT], and MicroSaint™) were used to address crew issues related to the utility of having rated aviators as crew members, supplementing current crews with imagery and intelligence specialists, and the use of automation to improve systems efficiency. Data from 70 soldiers and experts from Fort Huachuca, Arizona, Fort Hood, Texas, and Hondo, Texas, were collected as part of this effort. The general finding g was that the use of cognitive methods and computerized tool sets to understand future crew environments proved to be cost effective and useful. Specifically, no evidence was found to support a requirement for rated aviators in future Army missions, but the use of cognitively oriented embedded training simulators was suggested to aid novices in developing the cognitive skills evinced by experts. The efficacy of adding imagery specialists to 96U crews was discussed, and specific recommendations related to automation were derived from the workload modeling.

Barnes, M. J., & Matz, M. F. (1998). *Crew simulations for unmanned aerial vehicle (VAV) applications: sustained effects, shift factors, interface issues, and crew size*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society, Chicago, IL.

Barron, F., Block, J., MacKinnon, D. W., & Woodworth, D. G. (1958). An assessment study of Air Force officers: Part III. Assessment correlates of criteria of officer effectiveness. Lackland Air Force Base, TX: Personnel Laboratory.

Barry, J. R., Fulkerson, S. C., & Sells, S. B. (1956). Adaptability screening of flying personnel: Research on the McKinney Reporting Test. Brooks Air Force Base, TX: Personnel Research Laboratory.

Barry, J. R., Sells, S. B., & Trites, D. K. (1954). Psychiatric screening of flying personnel with the Cornell Word Form. *Journal of Consulting Psychology, 19*, 32.

Barry, J. R., Sells, S. B., & Trites, D. K. (1954). Psychiatric screening of flying personnel: Research on the Cornell Word Form. Randolph Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Bartlett, F. (1962). The outlook for flying personnel research. In A. B. Barbour & H. E. Whittingham (Eds.), *Human Problems of Supersonic and Hypersonic Flight*. London: Pergamon.

Bartlett, F. C., & Mackworth, N. H. (1950). *Planned seeing; some psychological experiments: I. Visibility in the control rooms of Fighter Command. II*. London,: H. M. Stationery Off.

Bartram, D. (1982). The development of a fully automated psychometric testing system: MICROPAT: *Ministry of Defence*.

Bartram, D. (1982). Leconfield Trials of the Micropat system: *Ministry of Defence*.

Bartram, D. (1986). Development and evaluation of MICROPAT Version 4: An analysis of data collected during the period October 1984 to August 1986 using Micropat Version 4.0 and 4.1. Hull, UK: Ergonomics Research Group, University of Hull.

Bartram, D. (1987). The development of an automated testing system for pilot selection: The MICROPAT project. *Applied Psychology: An International Review, 36*, 279-298.

Bartram, D. (1988). *The MICROPAT tests: Norms supplement*. Hull: NPAL.

Bartram, D. (1988). *The MICROPAT tests: software documentation for the test administration and profiler modules.* Hull: NPAL.

Bartram, D. (1988). Validation of MICROPAT Version 4. I: The prediction of RN Observer and Pilot grading outcome: Ministry of Defence.

Bartram, D. (1991). The Development and Validation of MICROPAT for Royal Navy Aircrew Selection: 1985-1991: Ministry of Defence.

Bartram, D. (1991). *MICROPAT Version 5.1: Normative Data*. Hull: Bartdale.

Bartram, D. (1993). Aptitude testing and selection in aviation. In R. Telfer (Ed.), *Aviation Training and Instruction* (pp. 34-51). Aldershot, Hampshire: Gower Ashgate.

Bartram, D. (1995). *Personality Factors in Pilot Selection: Validation of the Cathay Pacific Airways Selection Procedures*. Paper presented at the 8th International Symposium on Aviation Psychology, The Ohio State University.

Bartram, D. (1995). The predictive validity of the EPI and 16PF for military flying training. *Journal of Occupational and Organizational Psychology, 68*, 219-236.

The study was carried out to assess the validity of the Eysenck Personality Inventory (EPI) and Cattell's 16 Personality Factor Questionnaire (16PF) as predictors of flying training outcome. In addition, it examines differences in profile between self-selected applicants for flying training and the general population; the effects of test-taking conditions on scale scores; incidental selection effects related to personality differences and the reliability of the personality data. The EPI and 16PF inventories were administered to samples of men during selection testing at the RAF Officer and Aircrew Selection Centre, Biggin Hill. Further samples were tested at the Army Air Corps Centre at Middle Wallop prior to their Selection Board interviews. In addition, data were obtained for non-enlisted applicants tested at Biggin Hill and amateur aviators tested at various flying clubs. The results confirmed previous findings that applicants for pilot training are highly 'self-selected', being much more emotionally stable and more extraverted than the general population. Furthermore, the 16PF profile for the unselected sample was found to be very similar

to that for US airline pilots. The pattern of differences between those who succeeded and those who failed in training was as expected. The magnitude of these correlations (in the region of r = .20) was also at the level expected. The results support the findings of previous work and indicate that there are small but potentially valuable increments in validity to be obtained by considering personality factors in selection for pilot training. The problems associated with the use of self-report measures in selection are discussed.

Bartram, D. (1995). Validation of the Micropat Battery. *International Journal of Selection and Assessment, 3*, 84-95.

Bartram, D. (1999). Diseño, desarrollo y validaciõn de la bateria Micropat. In J. Olea, V. Ponsoda & G. Prieto (Eds.), *Tests Informatizados: Fundamentos y Aplicaciones* (pp. 307-324). Madrid: Ediciones Pir-mide.

Bartram, D. (2002). The MICROPAT Pilot Selection Battery: Applications of generative techniques for item-based and task-based tests. In S. Irvine & P. Kyllonen (Eds.), *Item Generation for Test Development* (pp. 317-337). Mahwah, NJ: Erlbaum.

Bartram, D., & Baxter, P. (1995). Cathay Pacific Airways Pilot Selection Validation. In N. Johnston, R. Fuller & N. McDonald (Eds.), *Aviation Psychology: Training and Selection* (pp. 194-199). Aldershot: Avebury Aviation, Ashgate.

Bartram, D., & Baxter, P. (1996). Validation of the Cathay Pacific Airways Pilot Selection Program. *International Journal of Aviation Psychology, 6*(2), 149-169.

Reports the validation of the Cathay Pacific ab initio, second officer (S/O) and first officer (F/O) pilot recruitment systems using performance ratings. Theory on the validity of predictors in selection; Operational criteria for the S/Os and F/Os; Levels of prediction. Reports the validation of the Cathay Pacific ab initio, second officer (S/O) and first officer (F/O) pilot recruitment systems using performance ratings. Theory on the validity of predictors in selection; Operational criteria for the S/Os and F/Os; Levels of prediction.

Bartram, D., & Choi, M. (1988). Evaluation of three computer-based tests of navigational ability (pp. 78): Ministry of Defense.

Bartram, D., & Dale, H. (1981). The EPI as a selection test for AAC pilots: Ministry of Defence.

Bartram, D., & Dale, H. (1982). Eysenck Personality Inventory as a selection test for military pilots. *Journal of Occupational Psychology, 55*, 287-296.

This research study empirically examined validities of personality constructs from the Eysenck Personality Inventory (EPI) for predicting pilot training success. Subjects were 432 British Army Air Corps (AAC) soldiers and 205 British Royal Air Force (RAF) cadets, both selected into training on the basis of cognitive ability tests. The EPI Extraversion, Neuroticism and Lie scales were administered in the AAC sample, while only the Extraversion and Neuroticism scores were available for the RAF sample. The criterion was pass/fail in their respective basic flight courses. Results for the AAC sample showed correlations with the training criterion of -. 11 for Neuroticism and .37 for Extraversion. Similar results were obtained for the

RAF sample, except the Neuroticism effect size was larger than the Extraversion effect size. The authors concluded that these personality constructs showed promise for prediction, especially in light of the small observed correlations with existing selection devices. Thus, the prospects for incremental validity are good.

Bartram, D., & Dale, H. (1983). Micropat Version 3: A description of the fully automated personnel selection testing system being developed for the Army Air Corps: Ministry of Defence.

Bartram, D., & Dale, H. (1984). Validation of the MICROPAT battery of pilot aptitude tests: Ministry of Defence.

Bartram, D., & Dale, H. (1985). An analysis of personality test inventory data administered to AAC applicants: Ministry of Defense

Bartram, D., & Dale, H. (1985). The validity of Micropat and personality measures for the prediction of success in helicopter pilot training: Ministry of Defence

Bartram, D., & Dale, H. (1991). Validation of the MICROPAT battery of pilot aptitude tests. In P. L. Dann, S. H. Irvine & J. M. Collis (Eds.), *Advances in Computer-Based Human Assessment* (pp. 149-170). Dordrecht: Kluwer.

Bartram, D., Dale, H., & Bayliss, R. (1983). Report on the concurrent validity of the Micropat test battery.: Ministry of Defence.

Bartram, D., Dale, H., Corkindale, K., & Dennison, D. (1985). The validity of Micropat tests for Army helicopter pilots. Farnborough, Hants: Army Personnel Research Establishment.
This report describes two Extramural Research Agreements to develop and validate computer based selection tests for Army Helicopter Pilot Selection. The main findings have shown that the new test battery, MICROPAT, will provide significant improvements over the P-score gained from existing selection tests in predicting flying training outcomes. Test equipment has proved reliable and robust, and the new form of testing acceptable to candidates. The main recommendation is that the MICROPAT should be implemented as part of the selection of helicopter pilots to replace the OASC, RAF Biggin Hill, selection measures.

Bartram, D., & Dale, H. C. A. (1985). *The prediction of success in helicopter pilot training*. Paper presented at the XVI Conference of the Western European Association of Aviation Psychology, Helsinki, Finland.

Bartram, D., & Faite, T. (1990). The equivalence of the IBM-PC and Sirton versions of the MICROPAT tracking tasks: Ministry of Defence.

Bartram, D., & Marshall, L. (1989). Validation of Micropat Version 4: II. The prediction of RN Observer and RN Pilot flying training outcomes: Ministry of Defence.

Bartram, D., & Marshall, L. (1990). Navor, Navcalc and Manikin. Psychometric evaluation of Micropat Versions 4.1. and 5.0: Ministry of Defence.

Bartram, D., & Marshall, L. (1990). Risk, Plane and Landing. The RNAS Culdrose Evaluation of Micropat Version 4.1. Supplement: Reliability Analysis: Ministry of Defence.

Bartram, D., & Marshall, L. (1990). Validation of Micropat Version 4: III. The prediction of Operational Flying Training Outcome for RN Observers and RN Pilots: Ministry of Defence

Bartram, D., & Marshall, L. (1991). The criterion-related validity of the RAF Executive (Phase One) and the Micropat tests for Royal Navy samples: Ministry of Defence

Barucky, J. M., & Stone, B. M. (1999). *Difficulties in Accessing a Representative Pilot Force: The Demographic Challenge and Views of Minority Pilot Focus Groups*. Paper presented at the Workshop of the Research and Technology Organization Human Factors and Medicine Panel (HFM) Meeting 55, Officer Selection (RTO-MP-55), Monterey, CA.

The United States Air Force has expressed concern about under representation of minority officers in its pilot force. Historically, there have been relatively smaller percentages of African-American and Hispanic officers among Air Force pilots than might be expected from other demographic and educational data. As part of a more general study of demographic trends and their effects on the Air Force personnel system, researchers were tasked to gather information pertaining to minority community attitudes about the military and flying careers. The researchers gathered this information from focus group interview sessions among African-American and Hispanic pilots and pilot trainees and from Air Force Academy and Air Force Reserve Officer Training Corps (AFROTC) minority recruiters. The responses highlight reasons for the lack of interest in flying careers among the most competitive minority students. They also offer suggestions for enhancing the selection/recruitment and training processes to attract a greater percentage of the highly qualified minority students and allow them to compete successfully for pilot positions. This paper presents a brief summary of that report.

Bates, M. J., Colwell, C. D., King, R. E., Siem, F. M., & Zelenski, W. E. (1997). Pilot performance variables. Brooks AFB: Armstrong Laboratory, Crew Systems Directorate.

Bates, R. C. (1973). Problems in recruiting Blacks for the service academies: A perspective. *Naval War College Review, 26*, 54-63.

Bayroff, A. G., & Fuchs, E. F. (1970). The armed services vocational aptitude battery. Arlington, VA: Army Behavioral and Systems Research Laboratory.

The document is concerned with the development of a common aptitude battery for use by all the services. The objective of the study reported was to identify among classification tests of the Army, Navy, and Air Force, those which were interchangeable in terms of abilities and aptitudes measured; and from those so identified, to develop shortened forms to constitute an alternate inter-service battery which would not require testing time in excess of two and one-half hours. Seven sets of tests were identified as interchangeable.

Bayroff, A. G., Ross, R. M., & Fischl, M. A. (1974). Development of a programmed testing system. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

This report describes an automated system for administering, scoring, and recording

results of multiple-choice tests. The system consists of examinee station, proctor station, an central computer the report describes the equipment and the programming characteristics of the respective components. The system is designed for tests tailored to the ability of the examinee, in which a more difficult question is presents after each correct answer or an easier question after each incorrect answer.

Beaty, D. (1969). *The human factor in aircraft accidents*. London,: Secker & Warburg.

Beaty, D. (1969). *The human factor in aircraft accidents*. New York,: Stein and Day.

Bekmezci, I. (1999). *Officer selection system in the Turkish Air Force*. Paper presented at the RTO HFM Workshop on Officer Selection, Monterey, CA.

In contrast to expectations, with the pace of developing technology, the human factor has become one of the most important elements in the organizations. Especially, in complex systems, like aviation, the human factor is even more critical. The fact that the cause of 80% of flight accidents in the last 40 years is related to human factor underlines the importance of human factor in this area.

Benel, R. A. (1976). SAM Complex coordinator and multidimensional pursuit test: Annotated Bibliographies. *Perceptual and Motor Skills, 42*, 327-338.

A brief description of the SAM Complex Coordinator (Mashburn Apparatus) and the SAM Multidimensional Pursuit Test (MDP or MPT) and annotated bibliographies including 144 and 51 citations respectively are presented. All references are annotated as to subject matter within six categories; Factor Analytic-Task Taxonomy, Aircrew Selection-Classification, Learning Phenomena, Stress Effects, History and Development, General Reviews.

Benton, C. J., Corriveau, P., Koonce, J. M., & Tirre, W. C. (1992). Development of the basic flight instruction tutoring system (BFITS) (pp. 23). Brooks Air Force Base, TX: Armstrong Laboratory, Human Resources Directorate.

Berg, J. S., Moore, J. L., Retzlaff, P. D., & King, R. E. (2002). Assessment of personality and crew interaction skills in successful Naval aviators. *Aviation, Space, and Environmental Medicine, 73*(6), 575-579.

PURPOSE: We were interested in studying a full range of successful aviators to discern which personality factors were present and whether these factors correlate with age, rank, and accumulated flight time. METHOD: The Armstrong Laboratory Aviator Personality Survey (ALAPS) was administered to 312 designated naval aviators and flight officers from a variety of aircraft communities. The sample included O-3/O-4 elite aviators who were selected for their squadron billets based on superior performance, O-5/O-6 aviators selected for command positions, and 59 flag officers. RESULTS: The junior aviators scored higher on the factor associated with Dogmatism and lower on the factor associated with Team Orientation and Socialness. This pattern was reversed for the flag officers, while O-5/O-6 aviators received intermediate scores on each of these factors. CONCLUSIONS: The present study demonstrates a correlation between specific ALAPS factors and experience, rank, age, and flight time. The combination of high Dogmatism, low Team Orientation, and low Socialness in junior aviators could suggest lower openness to crew input and increased risk for mishaps.

Berkshire, J. R. (1960). *Human quality control in Naval Air Training*. Paper presented at the U. S. Navy Tri-Service Conference on Selection Research.

Berkshire, J. R. (1967). Evaluation of several experimental aviation tests. Pensacola, FL: Naval Aerospace Medical Institute, Naval Aerospace Medical Research Laboratory.

Berkshire, J. R., & Ambler, R. K. (1963). The value of indoctrination flights in the screening and training of Naval aviators. *Aerospace Medicine, 34*, 420-423.

Berkshire, J. R., & Lyon, V. W. (1959). Human quality in Naval air training. *American Psychologist, 14*, 153-155.

Berkshire, J. R., & Nelson, P. D. (1958). Leadership peer ratings related to subsequent proficiency in training and in the fleet. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Berkshire, J. R., Wherry, R. J., & Shoenberger, R. W. (1964). Secondary selection in Naval aviation training. *Educational and Psychological Measurement, 25*, 191-198.

Berry, G. A., Harris, & Koonce, J. M. (1980). *The use of personality characteristics as predictors of psychomotor performance*. Paper presented at the Psychology in the Department of Defense Conference.

Berry, W. H. (1918). *Aircraft in War and Commerce*. New York: George H. Doran Co.

Bertrand, F., Teebax, V., & Hansez, I. (2008). *Qualitative analysis of pilot selection and basic flying training*. Paper presented at the 50th Annual International Military Testing Association Conference, Amsterdam, Netherlands.

Besco, R. O. (1991). *The myths of pilot personality stereotypes*. Paper presented at the 6th International Symposium on Aviation Psychology, Columbus, OH.

There has been a resurgence in the use of personality assessment in the aviation industry. Many personality profiles which have been subsequently developed have been heavily influenced by the conventional pilot stereotype. According to the author, these personality stereotypes are unable to distinguish good performers from poor performers. Aviation managers are looking to personality researchers for explanations of the causes of pilot errors and according to this author, are being misled. The author notes three factors that cause him to believe that the current state of the art personality research is flawed: (1) the lack of replication or cross validation; (2) biases and contamination in the performance evaluations; and (3) the transparency and fake-ability of the testing instruments.

Besco, R. O. (1994). Pilot personality testing and the emperor's new clothes. *Ergonomics in Design*, 24-29.

Bevan, W., Patton, R. M., & Wright Air Development Center. (1957). *Fatigue, stress, bodily*

change and behavior; selected bibliography. Wright-Patterson Air Force Base, Ohio: Wright Air Development Center, Air Research and Development Command, U.S. Air Force.

Bigelow, R. B. (1940). The evaluation of aptitude for flight training: The Rorschach method as a possible aid. *Journal of Aviation Medicine, 11*, 202-209.

Biggerstaff, S. (1999). *Factor Analysis of the U.S. Navy's Aviation Interest Subtest*. Paper presented at the 40th Annual International Military Testing Association Conference, Pensacola, FL.

Biggerstaff, S., Blower, D., Portman, C., & Chapman, A. D. (1998). The Effect of Presentation Medium on Pilot Selection Test Battery Scores. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Biggerstaff, S., Blower, D. J., Portman, C. A., & Chapman, A. D. (1998). The Development and Initial Validation of the Unmanned Aerial Vehicle (UAV) External Pilot Selection System. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Biggerstaff, S., Blower, D. J., & Portman, L. A. (1996). *Equivalence of the Computer-Based Aviation Selection Test Battery (ASTB)*. Paper presented at the 38th International Military Testing Association Conference.

Bijou, S. W. (Ed.). (1947). *The psychological Program in AAF convalescent hospitals. Report No. 15*. Washington, DC: U.S. Government Printing Office.

Bingham, H. (1920). *An Explorer in the Air Service*. New Haven, CT: Yale University Press.

Bingham, W. V. (1919). Army personnel work. *Journal of Applied Psychology, 3*(1), 1-12.
Discusses the specification of duties and qualifications necessary for personnel in war, industry, business and education. Emphasizes the need for a study of the army organization to determine where ability of various kinds is required. A Committee on Classification of Personnel was created, consisting of psychologists, industrial and business specialists, for employing, classifying, and assigning men. Enlists sixteen activities undertaken by the committee to achieve its purposes. People entering various fields of work need a clear definition of the duties for which they are being trained.

Bingham, W. V. (1941). Psychological services in the United States Army. *Journal of Consulting Psychology, 5*, 221-224.

Bingham, W. V. (1942). The Army personnel classification system. *Annals of American Academy of Political and Social Science, 220*, 18-28.

Bishop, B. (2003). The battle of Arras: The view from the air, 9 April 1917. In J. E. Lewis (Ed.), *The Mammoth Book of Eyewitness World War I* (pp. 280-284). New York: Carroll & Graf.

Bishop, S. L., Faulk, D., & Santy, P. A. (1996). The use of IQ assessment in astronaut screening and evaluation. *Aviation, Space, and Environmental Medicine, 67*(12), 1130-1138.

Bittner, A. C., Kennedy, R. S., Harbeson, M. M., & Lundy, N. C. (1980). *Apparatus testing for aviation performance assessment and selection: A technology ready to come of age.* Paper presented at the 28th International Congress of Aviation, Space, and Environmental Medicine, Montreal.

Bjerke, E., & Healy, M. (2010). Predicting student persistence: Pre-entry attributes that lead to success in a collegiate flight program. *Collegiate Aviation Review, 28*(1), 25-41.

The purpose of this study was to examine student pre-entry attributes to predict student persistence and academic success in a professional flight program. The data set constructed for this study was drawn from a sample of 390 full-time, first-time students enrolled at a University, with Commercial Aviation as their declared academic major at the time of entry. The data examined the students‘ academic progress for the first year to the second year of enrollment. Pre-existing data were gathered from each student‘s institutional record and financial aid record. Multiple regression analysis was used to calculate the degree to which pre-entry attributes predicted student persistence and academic success. The study found significant relationships between pre-entry attributes in determining student persistence and academic success. Pre-entry attributes accounted for 9.6% of the variance in persistence, and 32.3% of the variance in academic success.

Black, R. U. (2001, May). American Airlines Securing the Future. *Airline Pilot Careers,* 18-25.

Blower, D. J. (1990). Analysis of Naval Aviation Selection Test Data with Nonlinear Models. Part I. Parameter Estimation. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

The purpose of this paper is basically tutorial in nature and, as such describes an algorithm for estimating the parameters of a nonlinear model. This algorithm is called "simulated annealing." The actual workings of this algorithm are examined in some detail. The reason for studying this algorithm is because statistical analysis of naval aviation selection test data has always relied on the use of linear regression models. Linear models represent only a small subset of possible mathematical models that could be used as an empirical tool to predict aviator performance. Specifically, the whole class of nonlinear models has not been addressed. Recent research into neural networks and parallel distributed processing has uncovered some interesting nonlinear models. We intend to reanalyze the test scores of student naval aviators with a nonlinear model borrowed from the neural network literature. We hope that this new class of nonlinear models will be a more powerful tool in predicting aviator performance and will result in an improved naval aviator selection test battery.

Blower, D. J. (1992). Performance-Based Testing and Success in Naval Advanced Flight Training. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Roughly 5% of student naval aviators fail the advanced phase of flight training. At this stage of training, the Navy has spent between $300,000 and $1,000,000 per student. Any reduction in this attrition rate through prior screening would be of great economic benefit to the

Navy. Computer-based performance tests developed at the Naval Aerospace Medical Research Laboratory (NAMRL) were assessed to determine whether they could augment the present medical screening standards and thereby help identify potential failures in advanced flight training. A weak statistical relationship exists between a dual-task performance test, accession source, college major, an aptitude test, and success in advanced flight training. Discriminant analysis was employed to find a linear composite score of these variables that could be used to classify a student as a probable pass or fail in advanced flight training. For example, the model presented .n this report could reduce failures by 50% at the cost of rejecting roughly 20% of those students who eventually passed. A Bayesian analysis of the success rate parameter showed that this particular model did result in a significant improvement over the present selection system. These data can be used to make cost-benefit tradeoffs for aviation selection policy making. The author recommends that the dual-task performance test and accompanying statistical model discussed in this report be considered for operational implementation as part of an improved medical selection process for potential Navy and Marine Corps aviators.

Blower, D. J. (1992). Using Constraint Satisfaction Networks to Study Aircrew Selection for Advanced Cockpits. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Pilot selection techniques for the U.S. Navy must meet the challenges offered by the next generation of aircraft. One specific technological advance is likely to be the introduction of machine intelligence into the cockpit to assist pilots in their assigned tasks. We presently do not have any psychological tests in our selection toolkit to measure the cognitive skills needed to interact optimally with machine intelligence. This research has the goal of developing psychological tests, together with the accompanying mathematical models, to measure individual differences in pilot candidates with regard to cooperative human-machine problem solving. The groundwork for a constraint satisfaction network (CSN) approach to cooperative human-machine problem solving was laid down. The details and terminology of a simple CSN were explained. An algorithm to calculate the minimum energy of a CSN was explored in great depth. This algorithm is important because it is the basis for a numerical solution to the mathematical model underlying the CSN.

Blower, D. J. (1997). A cost-benefit analysis of the impact of selection testing on advanced flight training. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Blower, D. J. (1998). Probability of Success in Primary Flight Training as a Function of ASTB Scores and API Grades: An Example of the Statistical Inferencing Component of the Pilot Prediction System. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Blower, D. J., Albert, A. O., & Williams, H. P. (2000). Predicting flight grades by averaging over linear regression models: Part 2. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Blower, D. J., & Dolgin, D. L. (1990). *An evaluation of performance-based tests designed to predict success in primary flight training*. Paper presented at the 34th Annual Meeting of the Human Factors Society, Santa Monica, CA.

In 1986, the Naval Aerospace Medical Research Laboratory (NAMRL) completed the development of a performance assessment test battery designed to assess cognitive abilities,

higher-order processes, psychomotor skills, time-sharing ability, and personality traits. This automated performance-based test battery was intended to augment the Navy's paper-and-pencil selection tests for aviators. The main purpose of this study was to evaluate, in an hierarchical multiple regression model, the constituent tests comprising our performance-based test battery. To further such a goal, this paper presents a statistical assessment of all the tests in the battery when they enter as variables in a regression equation to predict success in primary flight training. Our analysis revealed that derived scores from three tests, (a) Absolute Difference-Horizontal Tracking (ADHT), (b) Complex Visual Information Processing (CVT), and (c) a Risk-Taking Task (RISK), were generally equivalent in predicting success. The derived scores from the Manikin, Baddeley, and Psychomotor/Dichotic Listening Task tests did not account for significant variance. In addition, the linear regression models were not improved by adding the variables of other test sets when the model already included one significant test set. In contrast, interactions of college major and accession source with derived scores of the three significant test sets contributed significant amounts of variability when added to the model. These results appear to indicate differential validity of these selection tests.

Blower, D. J., & Dolgin, D. L. (1991). An evaluation of performance-based tests designed to improve naval aviation selection. Naval Air Station Pensacola, FL: Naval Aeromedical Research Laboratory.

This report describes the evaluation of a portion of a new aircrew selection test battery recently developed at the Naval Aerospace Medical Research Laboratory. The results indicate that performance-based test measures can be said to predict flight training performance. Several test measures were reliably related to a pass/fail criterion. These results provide support for the prediction of whether or not a candidate will pass or fail training. The results of a hierarchical multiple regression revealed that scores from three tests, 1) Absolute Difference-Horizontal Tracking, 2) Complex Visual Information, and 3) Risk-taking Task, were generally equivalent in predicting success in primary flight training. Interactions of college major and accession source with derived scores of the three significant tests contributed significant amounts of variability when added to the model. We recommend that the valid tests from this study be implemented for operational use with the AQT/FAR. The use of hierarchical multiple regression with the tests will isolate those specific measures capable of accounting for added and unique variance, beyond that of the AQT/FAR and certain demographic variables, in the prediction of primary flight training course.

Blower, D. J., Dolgin, D. L., & Shull, R. N. (1990). Naval aviation selection test scores and female aviator performance *AGARD*: Advisory Group for Aerospace Research and Development.

Blower, D. J., Williams, H. P., & Albert, A. O. (2000). Predicting Primary Flight Grades by Averaging Over Linear Regression Models: Part I. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Boas, R. B. (1959). Vocational interests of Naval aviation cadets. *Journal of Applied Psychology, 43*(1), 70-73.

Boehm-Davis, D. A., Holt, R. W., & Hansberger, J. T. (1997). *Pilot abilities and performance*. Paper presented at the International Symposium on Aviation Psychology, Columbus, OH.

Boer, L. (1991). Spatial ability and orientation of pilots. In R. Gal & A. D. Mangelsdorff (Eds.), *Handbook of Military Psychology*. New York: Wiley & Sons.

Boer, L. C., & Castelijns, M. T. (1991). *The PILOT test as a predictor of pilot aptitude*. Paper presented at the XIXth Western European Association for Aviation Psychology Conference.

Boer, L. C., Harsveld, M., & Hermans, P. H. (1997). The Selective-Listening Task as a Test for Pilots and Air Traffic Controllers. *Military Psychology, 9*(2), 137.

Focuses on the use of selective-listening task (SLT) in determining the abilities of Royal Netherlands Air Force aviator and Navy air traffic controllers. Validity of SLT; Determination of errors after the switching of command; Influence of time between the signal to switch attention on the frequency of errors. Focuses on the use of selective-listening task (SLT) in determining the abilities of Royal Netherlands Air Force aviator and Navy air traffic controllers. Validity of SLT; Determination of errors after the switching of command; Influence of time between the signal to switch attention on the frequency of errors.

Bolstad, C. A. (1991). *Individual differences related to situational awareness*. Paper presented at the 35th Annual Meeting of the Human Factors Society, Columbus, OH.

A pilot's ability to maintain a high level of situation awareness (SA) has been widely recognized as an important component of mission success and survivability in the air combat arena. The need for SA enhancement has led to the creation of a test battery designed to measure pilot attributes that are thought to correlate to SA. By correlating SA performance measures with results from the selected attribute tests, it will be possible to develop highly focused instructional methods that will improve performance in the attributes, thus enhancing SA.

Bond, A. R. (1919). *Inventions of the Great War*. New York: The Century Co.

Bongers, S., & Pei, J. (2001). *The Australian Basic abilities Test (AUSBAT)*. Paper presented at the 43rd Annual International Military Testing Association Conference, Canberra, Australia.

An AUSBAT system comprises a battery of tests delivered by a flexible, low-cost test station. The system was developed to screen applicants for pilot training in the Australian Defence Force. Each test station consists of a two-joystick assembly connected to a desktop computer fitted with a Pentium-200/233 processor, 64 MB of RAM, and a 2 GB hard disk drive. The tests are presented to applicants on a 17-inch touch-screen monitor. The operating system is Microsoft Windows NT4 SP4. The tests were designed to measure aspects of working memory, spatial abilities, time-sharing under conditions of increasing work load, choice reaction time, perceptual-motor coordination, adaptation to changes in perceptual-motor demand, and the ability to cope with three kinds of divided attention tasks. Menus allow test difficulty levels and other parameters to be controlled by setting the relevant variables. For example, by selection of tests and/or test administration times, a battery can be assembled in a way that will test the applicant‘s tenacity over the time-frame in which he or she will have to perform during a training

sortie. Depending on the complexity of the particular task, the test instructions vary from a single page of text presented alongside a reproduction of the test screen through to several pages presenting interactive samples of each step to be taken. The paper describes the development of the AUSBAT system, its configuration, and the general thrust of the tests that comprise the battery.

Bonin, J. A. (1986). Toward the Third Dimension in Combined Arms: The Evolution of Armed Helicopters Into Air Maneuver Units in Vietnam, 1965-1973. Fort Leavenworth, KS: Command and General Staff College.

Bookheimer, W. R. (1996). *Predicting Naval Aviator Attrition Using Economic Data.* Master of Science, Naval Postgraduate School, Monterey, CA.

Boone, J. O., & Lewis, M. A. (1979). The selection of air traffic control specialists: Two studies demonstrating methods to ensure an accurate validity coefficient for selection devices. Oklahoma City, OK: Federal Aviation Administration.

Booth, R. F., & Peterson, F. E. (1968). Expansion of the naval flight officer student prediction system. Naval Air Station Pensacola, FL: Naval Aerospace Medical Institute.

Booth, R. F., Peterson, F. E., Lane, N. E., & Ambler, R. K. (1968). Predicting training success in non-pilot aviation specialties. *Aerospace Medicine, 39*, 466-467.

Boothe, R. F., & Berkshire, J. R. (1968). Factor analysis of aviation training measures and post-training performance evaluations. Naval Air Station Pensacola, FL: Naval Aeromedical Research and Development Laboratory.

Bor, R., & Hubbard, T. (2006). *Aviation mental health : psychological implications for air transportation*. Aldershot, England ; Burlington, VT: Ashgate.

Bor, R., & Kahr, B. (2004). *Anxiety at 35,000 feet : an introduction to clinical aerospace psychology*. London ; New York: Karnac.

Bordelon, V. P., & Kantor, J. E. (1986). Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

An Air Force Human Resources Laboratory (AFHRL) research and development (R&)) program was designed to capitalize on state-of-the-art technologies in computer-aided testing to develop accurate measures of psychomotor ability (hand-eye coordination) and then to investigate different ways to use these psychomotor measures in the selection of pilot training candidates . Psychomotor ability is one of several characteristics which historically have demonstrated relevance to flying performance . This report documents the validation of two tests of psychomotor ability against USAF Undergraduate Pilot Training (UPT) performance, and development of strategies to incorporate this information into the USAF pilot selection system. The two tests, Two-Hand Coordination and Complex Coordination, differentiated between UPT graduates and eliminees as well as between fighter- and non-fighter - recommended students . This differentiation can be used through the psychomotor screening system as an additional

selection gate for UPT candidates. Three Integrated Pilot Candidate Selection Models (IPCSMs) use all available information, including psychomotor measures, to improve attrition and quality in UPT and also reduce the rejection of potential graduates. Also, the IPCSMs can be used to screen minorities and women without bias. IPCSM I (Officer Training School Model) is the strongest system and is recommended for use as an input to the final selection decision for candidates going through the Flight Screening Program. IPCSM II (Air Force Reserve Officer Training Corps Model) could be used as a pre-selection input for Officer Training School or Air Force Reserve Officer Training Corps field training selection. IPCSM III (Air Force Academy Model) is not sufficiently stronger in prediction than the psychomotor screening system alone to warrant implementation. The implementation of psychomotor screening , either as a separate gate or within an integrated selection system, will improve the quality of student candidates in USAF Undergraduate Pilot Training. Based on the results of this effort, an integrated selection system including psychomotor screening is recommended . Future research should extend the information being considered and the criteria to be predicted.

Bortner, D. E., & Ree, M. J. (1977). Cost analysis of pilot selection systems. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Bory, A., & Goodman, L. S. (1983). *Validation of a Performance Based Pilot Selection System*. Paper presented at the Annual Scientific Meeting of the Aerospace Medical Association, Houston, TX.

Bowers, C. A., Jentsch, F., & Salas, E. (2000). Establishing aircrew competencies: A comprehensive approach for identifying CRM training needs. In D. H. Andrews & H. F. O'Neil (Eds.), *Aircrew Training and Assessment* (pp. 67-84). Mawhah, NJ: Lawrence Erlbaum Associates.

It has been just over a decade since the concept of Cockpit (later: Crew) Resource Management (CRM) 1 was introduced. During this time, CRM has gained almost universal acceptance as a useful addition to aircrew training programs (Wiener, Kanki, & Helmreich, 1993). In fact, CRM training programs are in place in almost every major air operation in the world. As a result, the acceptance of CRM training is, arguably, one the most apparent successes of applied psychology. Yet, we believe that it would be unwise to consider the problem of CRM training as solved. Although the promise of CRM training is well established, the practice of CRM training has recently come under attack. Some reports have suggested that CRM training has done little to impact aviation safety (General Accounting Office, 1997). Other reports have suggested that CRM training can have unintended negative consequences (Helmreich & Wilhelm, 1989). As crew coordination skills are now being evaluated as a qualification and certification requirement for many active pilots (Federal Aviation Administration, 1998; Joint Aviation Authorities, 1998), the pressure to demonstrate the efficacy of these programs is increasing (Mayes, 1998). Thus, optimizing the effectiveness of CRM training has become the next great challenge for aviation psychologists.

Boyd, H. A., and Boyles, W.R. (1969). *Attitudes as Predictors of Retention for Army Pilots*. Paper presented at the Annual Meeting of the Southeastern Psychological Association, New Orleans, LA.

Boyd, H. A., & Boyles, W. R. (1969). Attitudes as predictors of retention for Army pilots. Alexandria, VA: George Washington University Human Resources Research Office.

Boyd, J. L. (1972). *The impact of the civilian testing industry upon military personnel*. Paper presented at the 14th Annual Military Testing Association Conference, Lake Geneva, WI.

Boyett, J. E., McGraw, M. E., Simons, J. C., & Askren, W. B. (1988). Models that relate helicopter crew task performance to combat success. Volume II - model development. Dayton, OH: Universal Energy systems, Inc.

Boyett, J. E., McGraw, M. E., Simons, J. C., & Askren, W. B. (1988). Models that relate helicopter crew task performance to combat success. Volume I - project summary. Dayton, OH: Universal Energy Systems, Inc.

Boyle, D. J., & Hagin, W. V. (1953). The light plane as a pre-primary selection and training device: I. Analysis of operational data: U.S. Air Force Human Resources Research Center.

Boyles, W. R. (1969). Measures of reaction to threat of physical harm as predictors of performance in military aviation training. Alexandria, VA: Human Resources Research Organization.

Boyles, W. R., Boyd, H. A., & Prophet, W. W. (1967). The aviation warrant officer: Biographical and attitudinal characteristics. Alexandria, VA: Human Resources Research Organization.

Boyles, W. R., Prunkel, P. R., & Wahlberg, J. (1969). Combat aviator criterion development. Alexandria, VA: Human Resources Research Organization.

Boyles, W. R., Prunkl, P. R., & Wahlberg, J. L. (1969). *Combat aviator criterion development*. Paper presented at the American Psychological Association Annual Convention, Washington, DC.

Boyles, W. R., & Wahlberg, J. (1971). Prediction of Army aviator performance: Description of a developing system. Alexandria, VA: Human Resources Research Organization.

Boyles, W. R., & Wahlberg, J. L. (1970). Prediction of Army aviator performance: Description of a developing system. Alexandria, VA: Human Resources Research Organization.

Braithwaite, G. R. (2001). *Attitude or latitude? Australian Aviation Safety*. Aldershot, Hants, England ; Burlington, USA: Ashgate.

Bramble, W. J., Jr. (1997). *Development of behaviorally-anchored scales for rating commuter pilot job performance*. Paper presented at the 9th International Symposium on Aviation Psychology, The Ohio State University.

Bramble, W. J., Jr. (1998). *General ability, conscientiousness, and stability as predictors of regional airline first officer job performance*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society.

General ability, conscientiousness, and stability were evaluated as predictors of first officer (FO) job performance. Predictive variables were measured using the Prevue Assessment (Bartram, 1994) during a pre-employment screening process. Job performance was assessed later, using behaviorally-anchored rating scales (Bramble, 1997). Ratings were made by fellow crewmembers (airline captains). Analysis of the rating data yielded two orthogonal factors, a ~~"p~~proficiency" factor and an ~~"in~~terpersonal" factor. Factor loadings were used to generate two composite performance measures for each FO. Stability was the only predictor, which correlated significantly with either composite measure. Pilots who were more emotionally stable achieved higher scores on the proficiency measure ($r = .33$, $p = .006$). The correlation between general ability and the interpersonal performance measure approached significance ($r = .22$, $p = .071$) but did not exceed the traditional criterion ($p < .05$). Implications for commercial pilot selection are discussed.

Braun, P., Fresnius, A., & Kempf, K. (1989). *A computer-based test battery for pilot selection based on action theory*. Paper presented at the 31st Annual Military Testing Association Conference, San Antonio, TX.

Braun, P., Wiegand, D., & Aschenbrenner, H. (1991). The assessment of complex skills and personality characteristics in military services. In R. Gal & A. D. Mangelsdorff (Eds.), *Handbook of Military Psychology* (pp. 37-61). Chichester: John Wiley and Sons.

These authors reviewed the personnel selection and measurement literatures, focusing on complex skills and personality in the military services. They discuss several issues, especially how one can evaluate the methodological quality of psychodiagnostic procedures and issues concerning when one would expect measures to demonstrate predictive validity. The review explores research pertaining to application documents, biographical data, scholastic achievement, personality inventories, ratings, interviews and computer-based tests. The authors note that, historically, biodata has played a very important role in the prediction of organizationally relevant criteria for the military. The validities for these types of predictors and a wide variety of criteria are reported. The authors conclude that reality-close assessment situations (assessment centers) hold much promise as selection measures for the military services and their demonstrated validity justifies their high development costs

Braune, R., Hulin, C. L., & Wickens, C. D. (1984). *The importance of the criterion measure in aviator selection: An example*. Paper presented at the 26th Annual Military Testing Association Conference, Munchen, FRG.

Braune, R., Stokes, A., & Wickens, C. D. (1985). *An exploratory study of computer-based aviator testing*. Paper presented at the 3rd Symposium on Aviation Psychology, Columbus, OH.

The data obtained by Braune and Wickens (1984) during the 'Functional Age Profile' validation test for aviators are reanalyzed, to test the information processing performance battery's predictive power at a level independent of age-related changes. A total of fifty single and dual task performance variables were submitted to a stepwise multiple regression analysis.

The results on correlations of selected single and dual task measures with the primary flight performance measures and the secondary communications task are discussed. (I.S.)

Braune, R., & Wickens, C. (1984). Individual differences and age-related performance assessment in Naval aviators Parts 1 and 2: Engineering Psychology Research Laboratory.

Braune, R., & Wickens, C. D. (1985). The functional age profile: An objective decision criterion for the assessment of pilot performance capacities and capabilities. *Human Factors, 27*(6), 681-693.

The initial development of a computer-based information-processing performance battery with aviation-relevant task structures is reported. It is shown that the currently existing prototype is sensitive to individual differences within chronological age groups as well as to age-related changes across different age groups. The utilization of such a test battery for the longitudinal assessment of aviator performance capabilities is discussed.

Braune, R., Wickens, C. D., & Stokes, A. F. (1984). *Computer Based Aviator Selection: Initial Validation Of An Information Processing Performance Battery*. Paper presented at the 26th Annual Military Testing Association Conference, Munchen, FRG.

Brehaman, G. E. (1957). A note on the relationship of the Interaction Potential Inventory to peer ratings of leadership and Naval aviation cadet criteria. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Brictson, C. A., Burger, W. J., & Gallagher, T. J. (1972). Prediction of pilot performance during initial carrier landing qualification. *Aerospace Medicine, 43*, 483-487.

Briggs, G. E., Bahrick, H. P., & Fitts, P. M. (1957). The influence of force and amplitude cues of learning and performance in a complex tracking task: USAF Personnel and Training Research Center.

Brimhall, D. R., & Franzen, R. (1944). A preliminary study of physical standards in relation to success in flight training Washington, DC: U.S. Department of Commerce.

Brooks, K. E., & Hopkins, E. W., 3rd. (1997). An aviator with an unusual gait: a rare disease teaches some everyday lessons. *Aviation, Space, and Environmental Medicine, 68*(2), 147-150.

Muscular diseases including the dystrophies and myopathies are often incompatible with a variety of occupations including aviation and military duty. Many of these diseases present early in life, are readily diagnosable, and are therefore rare in the aviation community because of pre-screening and selection. Some forms, however, may not present until adulthood during an established aviation career. Furthermore, although initial presentations may be subtle and insidious, the potential occupational and aeromedical ramifications of these diseases can be profound. The following report describes the case of a subjectively asymptomatic career military aviation officer who presented with an unusual gait, and was subsequently determined to have one of the late-presenting muscle disease variants: Anterior compartment Distal Myopathy. The

patient's presentation and progression, diagnostic evaluation, prognosis, aeromedical risk and disposition, and issues of occupational and aeromedical significance are discussed.

Brown, D. C. (1989). Officer aptitude selection measures. In M. F. Wiskoff & G. M. Rampton (Eds.), *Military Personnel Measurement: Testing, Assignment, Evaluation*. New York: Praeger.

Brown, J. S., Knauft, E. B., & Rosenbaum, G. (1948). The accuracy of positioning reactions as a function of their direction and extent. *American Journal of Psychology, 61*, 167-182.

Brown, N. M., & Moren, C. R. (2003). Background emotional dynamics of crew resource management: Shame emotion and coping responses. *International Journal of Aviation Psychology, 13*(3), 269-286.

We propose emotional dynamics are involved in crewmembers‘ occasional failure to communicate relevant information or concerns in the cockpit. Pilots‘ normal coping responses to 1 of Silvan Tomkins‘s 9 basic affects, shame, may give rise to apprehensiveness about communicating unverified information, as well as behavioral emphasis on competence and professionalism, and even check-ride anxiety. Our data suggest that pilots are more excitement-hungry than nonpilots, and that this quality is associated with a tendency to avoid self-blame in awkward situations and to focus instead on excitement, enjoyment, or self-confidence. We recommend new training addressing these avoidance responses to awkward situations in the cockpit.

Brown, W. F. S., & Trites, D. K. (1957). Adaptability screening of flying personnel: Early flight behavior as an index of subsequent adaptability to flight. Brooks Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Brown, W. R., Dohme, J. A., & Sanders, M. G. (1981). *Changes in the US Army aviation selection and training program*. Paper presented at the Symposium on Aviation Psychology, Columbus, OH.

Brown, W. R., Dohme, J. A., & Sanders, M. G. (1982). Changes in the U.S. Army aviator selection and training program. *Aviation, Space, and Environmental Medicine, 53*(12), 1173-1176.

The Army's aviator selection program began in the mid 1950's. The first Flight Aptitude Selection Test (FAST) was implemented in 1966 and remained in use until 1980 when changes in personnel, aircraft, and tactics necessitated an improved or revised FAST (RFAST). This paper presents an overview of 1) the composition of the FAST and RFAST; 2) the advantages of the RFAST; and 3) the predictive validity estimates for the FAST and RFAST. Also presented are examples of current research projects which show promise for increasing effectiveness and for broadening the scope of the Army aviator selection program.

Brown, W. R., Dohme, J. A., & Wick, D. C. (1980). An evaluation of minority and female performance in Army rotary wing aviation training. Volume II: Evaluation Report. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. This report contains the evaluation of minority (Black, Hispanic, Asian, American

Indian) and Female performance in the Army's Initial Entry Rotary Wing flight training program. Each minority group was compared to a matched sample of majority students. The groups were matched on FAST score, GT score, education level, age, rank, and source of entry. The performance of the two groups (each minority and its matched control group) was compared on the following criteria: (1) Warrant Officer Candidate Military Development Course grades; (2) Academic grades by phase of training; (3) Flight performance grades by phase of training; (4) Overall grade; (5) Attrition experience during the Warrant Officer Development Course and; (6) Attrition experience during the flight portion of training.

Brown, W. R., Dohme, J. A., & Wick, D. C. (1980). An evaluation of minority and female performance in Army rotary wing training. Volume I: Executive Summary. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

This report contains the Executive Summary of the evaluation of minority (Black, Hispanic, Asian, American Indian) and Female performance in the Army's Initial Entry Rotary Wing flight training program. Each minority group was compared to a matched sample of majority students. The groups were matched on FAST score, GT score, education level, age, rank, and source of entry. The performance of the two groups (each minority and its matched control group) was compared on the following criteria: (1) Warrant Officer Candidate Military Development Course grades; (2) Academic grades by phase of training; (3) Flight performance grades by phase of training; (4) Overall grade; (5) Attrition experience during the Warrant Officer Development Course and; (6) Attrition experience during the flight portion of training.

Brown, W. R., & Shipley, B. D. (1983). Evaluation of attrition in US Army flight training program: FY 81 and 82. Ft Rucker, AL: U.S. Army Research Institute Field Unit.

Bruce, P. D. (1989). Aircrew training evaluation: B-52 and KC-135 formal school training (pp. 47). Brooks Air Force Base, TX: Air Force Human Research Laboratory.

This report documents a descriptive and analytical investigation of the training information and evaluation system which supports the initial qualification, pilot/navigator-upgrade, and requalification training programs for B-52 and KC-135 aircrews at the 93 Bombardment Wing (BMW), Castle AFB, California. The rationale for the study was that improvements in aircrew training evaluation must be based upon adequate understanding of current practice. A description of the training information system is organized according to the temporal sequence in which information is collected, and according to the offices in which information is collected and processed. It was concluded that sufficient data are gathered for the evaluation of students as they progress through the program of instruction, yet little of this information is used, in turn, for systematic evaluation of the training system. The limitations of the present information and evaluation system were interpreted as a function of past Air Force requirements for evaluation, a manual record keeping system, parallel evaluation functions performed by several of the offices within the Wing, and the absence of an overall integrated evaluation plan. (TDM)

Bruskiewicz, K. T., Hezlett, S. A., & Houston, J. S. (2007). Development of a classification method and assessment instrument for advanced aircraft training. Minneapolis, MN: Personnel Decisions Research Institutes.

Bruskiewicz, K. T., Houston, J. S., Hezlett, S. A., & Ferstl, K. L. (2007). Development of a selection instrument for Unmanned Aerial System (UAS) operators. Minneapolis, MN: Personnel Decisions Research Institutes.

Bruskiewicz, K. T., Katz, L. C., Houston, J., Paullin, C., O'Shea, G., & Damos, D. (2007). Predictor development and pilot testing of a prototype instrument for Army flight training. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Bruskiewicz, K. T., Logan, K. K., Hedge, J. W., & Hanson, M. A. (1997). Annotated bibliography of research relevant to the development and validation of the situational test of aircrew response styles inventory. Brooks AFB, TX: U.S. Air Force Armstrong Laboratory.

TThis annotated bibliography was constructed as a resource aid to be used in the development and validation of the Situational Test of Aircrew Response Styles (STARS). It reviews research reported before approximately 1993 and had three primary goals to identify: (a) those personality or interpersonal skills constructs relevant for performing effectively as an aircraft commander; (b) which of these constructs could be measured using a situational judgment test (SJT) format; and (c) criteria appropriate for validating a test such as the STARS. Research reports from three general areas were targeted for inclusion in this bibliography: (a) pilot personality; (b) situational judgment tests; and (c) crew resource management. Both computerized and manual literature searches were conducted. The computerized searches were conducted in several different databases: (a) Books in Print; (b) ERIC; (c) the National Technical Information Service (NTIS); (d) Psychological Abstracts; (e) Dissertation Abstracts; and (f) the Government Printing Office (GPO) Publications Reference File. The Defense RDT&E On-Line System (DROLS) was also used to access the Defense Technical Information Center technical report database. In addition, the reference sections of all relevant articles were manually searched. Using these search methods, 93 pilot personality, 27 situational judgment test, and 150 crew resource management articles were identified and reviewed.

Buckle, P. W., David, G. C., & Kimber, A. C. (1990). Flight deck design and pilot selection: Anthropometric considerations. *Aviation, Space, and Environmental Medicine, 61*(12), 1079-1084.

Safe and successful operation of flight displays and controls is, in part, dependent on the anthropometric characteristics of the pilots with respect to the design of a particular aircraft. This paper describes the approach required to optimise this fit and provides guidelines for both those responsible for design and those who select pilot recruits. The major results reported are those for a British population, although the aircraft considered (Boeing 737-200, 747, 757 and Lockheed TriStar) are used by airlines throughout the world. The study shows that limitations in design considerably reduce the pool of potential recruits with the appropriate anthropometric characteristics. The selection criteria, based on functional seated eye height, might exclude 73% of the British, 19-65-year-old female population and 13% of the male population.

Bucky, S. F. (1971). The California Psychological Inventory given to incoming AOC's and DOR's with normal and "ideal" instructions. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

The present study was conducted in order to determine whether 1) the California Psychological Inventory (CPI) would be able to discriminate between incoming aviation officer candidates (AOC's) and other students who voluntarily dropped out of the flight program (DOR's); and 2) if not , whether changing the set so as to ask the subjects to take the test "as they would like to be" would help make the discrimination. The CPI was administered to 95 AOC's and 51 DOR's with instructions to take the test with its normal instructions. Another group of 173 AOC's and 32 DOR's took the test with " ideal" instructions. The results indicate that entering AOC's and DOR's obtained almost identical scores during the normal administration of the test, but with the "ideal" instructions, AOC's obtained significant elevations on 11 of 18 scales ; whereas, only 2 scales were significantly elevated for the DOR group. The results suggest that the CPI should be investigated as a possible aid in the prediction of the DOR.

Bucky, S. F., & Ridley, S. L. (1972). California Psychological Inventory as a predictor of success in the naval flight program. *Aerospace Medicine, 43*, 971-973.

The authors state that although personality inventories had previously differentiated outstanding from average pilots, they were less successful in predicting drop-outs. The authors propose that pilots may be a homogeneous group with respect to personality and that the mental "set" they adopt when completing instruments may muddle the results. In this study, they proposed that they could change the mental set by including a condition in which respondents are told to complete the inventory "as you would like to be." The sample was composed of 3 15 U.S. Navy aviation officer candidates with 283 of these then taking the "as you would like to be" condition. All subscales of the California Psychological Inventory (CPI) were administered and the criterion was dichotomous (finish or voluntary withdraw from flight training). The only scale that differentiated between the finish and withdraw groups was the Communality scale. Nearly all scale scores were elevated in the "as you would like to be" condition. The authors recommended that an item analysis of the Communality scale be completed.

Bucky, S. F., & Spielberger, C. D. (1973). *State and trait anxiety in the voluntary withdrawal of student Naval aviators from flight training*. Paper presented at the 81st Annual Conference of the American Psychological Association.

Bucky, S. F., & Spielberger, C. D. (1973). State and trait anxiety in the voluntary withdrawal of student Naval aviators from flight training. *Psychological Reports, 33*, 351-354.

Bunning. (2005). Jobs aplenty, but too few pilots. *Civil Aviation Training,* 6-9.

Burke, E. (1995). Male-female differences on aviation selection tests: their implications for research and practice. In N. Johnston, R. Fuller & N. McDonald (Eds.), *Aviation Psychology: Training and Selection* (Vol. 2, pp. 188-193). Aldershot: Avebury.

Burke, E., Hobson, C., & Linsky, C. (1997). Large sample validations of three general predictors of pilot training success. *International Journal of Aviation Psychology, 7*(3), 225-234.

Burke, E., Kitching, A., & Valsler, C. (1994). Computer-based assessment and the construction of valid aviator selection tests. In N. Johnston, R. Fuller & N. McDonald (Eds.), *Aviation Psychology: Training and Selection*. Cambridge: Avery.

Burke, E., Kitching, A., & Valsler, C. (1995). Computer-based assessment and the construction of valid aviator selection tests. In N. Johnston, R. Fuller & N. McDonald (Eds.), *Aviation Psychology: Training and Selection* (Vol. 2, pp. 282-290). Aldershot: Avebury.

Burke, E., Kitching, A., & Valsler, C. (1997). *The pilot aptitude tester (PILAPT): On the development and validation of a new computer-based test battery for selecting pilots*. Paper presented at the 9th International Symposium on Aviation Psychology, The Ohio State University.

Burke, E. F. (1987). *Current trends in pilot selection research: Introduction and examples from current RAF research*. Paper presented at the 27th Annual Military Testing Association Conference, Ottawa, ON, Canada.

Burtt, H. E. (1918). The perception of slight changes of equilibrium, with especial reference to problems of aviation. *Journal of Applied Psychology, II*, 101-115.

Burwell, R. R. (1957). Historical review of aircrew selection: Development of psychological selection of pilots in the United States Air Force and predecessor organizations in the United States Army. Randolph Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Butcher, J. N. (1994). Psychological assessment of airline pilot applicants with the MMPI-2. *Journal of Personality Assessment, 62*(1), 31-44.

Butcher, J. N., Jeffrey, T., Cayton, T. G., Colloigan, S., DeVore, J. R., & Minnegawa. (1990). A study of active duty military personnel with MMPI-2. *Military Psychology, 2*(1), 47-61.

Caldwell, J. A., Jones, H. D., Carter, D. J., & Caldwell, J. L. (1992). The relationship between computer scoring and safety-pilot grading of flight performance. Ft Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Three different measures of helicopter pilot performance were correlated--two types of computer scores and one type of safety/instructor pilot grades. Results indicated the two types of computer scores were basically interchangeable. The direction of the relationship between the different types of computer and safety-pilot measures was as expected for 76 percent of the measures examined, but statistical significance was attained in fewer cases (approximately 50 percent of the total). Reasons for any noted discrepancies are discussed along with findings about the most strongly associated measures. The computer scores and safety-pilot grades were related strongly enough to conclude that they were both accurately measuring the same type of performance.

Calkin, B. A. (2007). *Parameters affecting mental workload and the number of simulated UCAVS that can be effectively supervised.* Master of Science, Wright State University. As Unmanned Combat Aerial Vehicles (UCAVs) become integrated into the U.S. military's arsenal, the number of vehicles that an operator can successfully supervise will play an important role in the effectiveness of future missions. The present study

investigated performance and mental workload when an operator supervises multiple UCAVs. This study focused on the parameters that affect the operator's performance during a simulated UCAV suppression of enemy air defenses (SEAD) mission, which is expected to be the primary function of the UCAV. All three factors which were manipulated, including the number of vehicles to be supervised, vehicle airspeed, and difficulty level of attacks (targets engaged by either a single vehicle or multiple vehicles), affected both performance and Subjective Workload Assessment Technique (SWAT), and NASA Task Load Index (TLX), subjective mental workload measures. Accomplishment score analyses were used to estimate performance redlines, based on the Accomplishment Score Model of Average Mental Workload (Colle & Reid, 1997, 2005). A performance mental workload redline was defined as the point at which accomplishment scores no longer increased. Performance redlines were estimated using piecewise linear functions of accomplishment scores. Redlines indicated that for simple scenarios operators could effectively control about 12 UCAVs flying at 900 knots or 8 UCAVs flying at 1500 knots. For complex scenarios, operators could effectively control 8 UCAVs flying at 900 knots. Subjective mental workload redlines also were estimated for both the SWAT and TLX subjective mental workload measures based on the performance redlines. Consistent with iv previous research, the estimated SWAT redline was in the range of 40 ± 10. Initial estimates of a redline also were obtained for the TLX.

Callister, J. D., King, R. E., Lanier, D. C., & Etterle, P. M. (1995). *Neuropsychiatrically enhanced flight screening: A pilot baselining and validation effort*. Paper presented at the 8th International Symposium on Aviation Psychology, Columbus, OH.

Callister, J. D., King, R. E., & Marsh, R. W. (1997). Using the NEO-PI-R to assess the personality of US Air Force pilots. Brooks Air Force Base, TX: Armstrong Laboratory. The study of pilot personality has a long and controversial history. Personality characteristics are fairly poor predictors of training completion, but are probably better predictors of operational performance. Personality characteristics are also important considerations in clinical psychological assessment. The current paper describes the personality characteristics of 1301 US Air Force students pilots based on the NEO Personality Inventory (NEO-PI-R). Compared to male adult norms, male student pilots had higher levels of extraversion and lower levels of agreeableness. Compared to female adult norms, female student pilots had higher levels of extraversion and higher levels of openness as well as lower levels of agreeableness. Percentile tables for the five domain scores and 30 facet scales are provided and discussed for clinical use. A case study is also provided as an example of the clinical utility of these US Air Force norms.

Callister, J. D., King, R. E., & Retzlaff, P. D. (1995). Cognitive assessment of USAF pilot training candidates: Multidimensional aptitude battery and cogscreen-aeromedical edition: Armstrong Laboratory.

Callister, J. D., King, R. E., & Retzlaff, P. D. (1996). *Cognitive abilities and personality characteristics of female Undergraduate Pilot Training (UPT) candidates*. Paper presented at the Scientific Meeting of the Aerospace Medical Association, Atlanta, GA.

Callister, J. D., King, R. E., & Retzlaff, P. D. (1996). Cognitive assessment of USAF pilot training candidates. *Aviation, Space, and Environmental Medicine, 67*(12), 1124-1129.

Callister, J. D., King, R. E., & Retzlaff, P. D. (1997). *The myth of a pilot personality and the need for valid personality assessment*. Paper presented at the 9th International Symposium on Aviation Psychology, Columbus, OH.

Callister, J. D., King, R. E., Retzlaff, P. D., & Marsh, R. W. (1999). Revised NEO personality inventory profiles of male and female U.S. Air Force pilots. *Military Medicine, 164*, 885-890.

Callister, J. D., King, R. E., & Retzlaff, P. R. (1996). Cognitive abilities and personality characteristics of female undergraduate pilot training candidates. Paper presented at the Annual Scientific Meeting of the Aerospace Medical Association. *Aviation, Space, and Environmental Medicine, 67*, 688.

Callister, J. D., & Retzlaff, P. D. (1996). *The USAF's Enhanced Flight Screening Program: Psychological assessment of Undergraduate Pilot Training candidates*. Paper presented at the Aerospace Medical Panel Symposium on Selection and Training Advances in Aviation (NATO Advisory Group for Aerospace Research and Development), Prague, Czech Republic.

Cameron, R. H. (1999). *Training to fly: Military flight training 1907-1945*: U.S. Air Force.

Campbell, C. (1980). *Pilot screening research*. Paper presented at the Biannual Department of Defense Psychology in the Air Force Symposium.

Campbell, D. P. (1968). *SVIB results for military and civilian samples*. Paper presented at the 10th Annual Military Testing Association Conference, San Antonio, TX.

Campbell, J. S., Castaneda, M., & Pulos, S. (2010). Meta-analysis of personality assessments as predictors of military aviation training success. *International Journal of Aviation Psychology, 20*(1), 92-109.

Results from a meta-analysis of studies using personality constructs to predict military aviation training outcomes are reported. From the 26 studies that reported effects of personality as predictors of aviation training outcome, the constructs of neuroticism (K = 7), extroversion (K = 8), and anxiety (K = 4) appeared most frequently. Meta-analysis effects were derived using both random effects and artifact distribution model. Uncorrected effects from the random effects model produced the largest mean effect for neuroticism (r_{meta} = -.15), followed by extroversion (r_{meta} = .13), and anxiety (r_{meta} = -.11). Corrections for predictor reliability and range restriction produced the greatest increase in the validity coefficient for neuroticism (r_{corr} = -.25), implying more psychometrically reliable and sensitive instruments could substantially improve the predictive validity of personality assessments in aviation selection contexts. The results confirmed the hypothesis that neuroticism and its facet anxiety would be negatively related to training success, and that extroversion would share a positive relationship with training success in military aviation.

Cangemi, J. P. (1977). Some comments on the use of psychometric testing of personality in the selection of military officers. *Psychology, 14*(4), 69-70.

Cantor, M. (2003). *Waypoint: A new Aptitude Assessment for Aviators*. Paper presented at the 12th International Symposium on Aviation Psychology.

Cantwell, G. T. (1997). *Citizen Airmen: A History of the Air Force Reserve, 1946-1994*. Washington, DC: DIANE Publishing.

For nearly fifty years, citizen airmen have served in the nation's defense as members of the Air Force Reserve. Citizen Airmen: A History of the Air Force Reserve, 1946 -1994 begins with the fledgling air reserve program initiated in 1916, traces its progress through World War II, and then concentrates on the period 1946 through 1994. The study skillfully describes the process by which a loosely organized program evolved into today's impressive force. The Air Force Reserve story is told within the context of national political and military policy and stresses that over the decades, as national needs have increased, reservists have met the challenges. Initially, the Air Force treated its reserve units as supplemental forces and equipped them with surplus equipment. Shortly after the Air Force Reserve was established in 1948, its members mobilized for Korean War duty and they served throughout the conflict. The Reserve program subsequently fell into disarray and required patient rebuilding. The passage of a series of key federal laws related to personnel issues and the introduction of the air reserve technician program greatly assisted in this rejuvenation process. In the l96Os, the Air Force Reserve demonstrated its mettle as it participated in numerous mobilizations reflecting the Cold War tensions of the era. Reservists were involved in operations ranging from the Berlin Crisis of 1961-1962 to the Southeast Asia mobilizations in 1968. In the 1970s, the Air Force Reserve program assumed heightened importance when the Department of Defense adopted the Total Force Policy. This concept treated the active forces, the National Guard, and all reserve forces as an integrated force. Reservists were now expected to meet the same readiness standards as their active duty counterparts. Since then, the Air Force Reserve has demonstrated its ability to perform a wide variety of missions. Air Reservists participated in American military operations in Grenada and Panama.

Carlson, W. A. (1940). Aviation and its medical problems. *Army Medical Bulletin, 53*, 11-20.

Carlson, W. A. (1941). Intelligence testing of flying cadet applicants: A report on psychometric measurement. *Journal of Aviation Medicine, 12*(3), 226-229.

Carlstedt, L. (1967). *Prediktion av militär flygförarlämplighet*. Stockholm,: Militärpsykologiska institutet.

Carlstrom, A. (1984). Correlations between selection ratings and success as Army aviators. Stockholm, Sweden: Forsvarets Forskningsanstalt Huvudavdelning.

Carretta, T. (1987). *The Basic Attributes Test: An experimental selection and classification instrument for U.S. Air Force Pilot Candidates*. Paper presented at the 4th International Symposium on Aviation Psychology, Columbus, OH.

High rates of attrition among students in Undergraduate Pilot Training (UPT) are a major concern for the U.S. Air Force. Recent efforts at the Air Force Human Resources Laboratory have attempted to reduce attrition rates by improving the method by which pilot candidates are selected. Currently, UPT students are chosen primarily on the basis of their Pilot and Navigator-Technical composite scores from the Air Force Officer Qualifying Test (AFOQT). The present effort sought to determine the extent to which scores on an experimental test battery, known as the Basic Attributes Tests (BAT), added to the validity provided by the Pilot and Navigator-Technical composite scores. The BAT battery consisted of eleven subtests and measured psychomotor skills, as well as a variety of cognitive/perceptual abilities and personality/attitudinal characteristics believed to be related to pilot training performance.

Carretta, T., Retzlaff, P. D., Callister, J. D., & King, R. E. (1998). A comparison of two U.S. Air Force pilot aptitude tests. *Aviation, Space, and Environmental Medicine, 69*(10), 931-935.

Carretta, T. R. (1986). *The basic attributes tests (BAT) system: A preliminary evaluation of three cognitive subtasks*

Carretta, T. R. (1986). *The Basic Attributes Tests (BAT) System: A preliminary evaluation of three cognitive subtasks*. Paper presented at the South Texas Symposium on Human Factors and Ergonomics.

In 1955, the U.S. Air Force discontinued apparatus-based testing as a component of its aircrew selection and classification system due to administrative problems. Since then, the Air Force has relied on paper and pencil test batteries such as the Air Force Officer Qualifying Test to select pilot and navigator trainees. Unfortunately, the aircrew selection system without apparatus testing has failed to produce acceptable attrition rates in the light of escalating training costs. As a result, a computer based testing system, the Basic Attributes Tests (BAT) system, was developed to assess psychomotor skills as well as a variety of psychological and cognitive attributes that are believed to be related to flight training performance. This paper evaluated three subtests used to assess cognitive abilities: Perceptual Speed (information input efficiency), Decision Making Speed (low level cognitive and high level sensory-perceptual motor involvement) and Item Recognition (short-term memory storage, search and comparison operations). Each of the subtests was evaluated in terms of its internal consistency and ability to predict flight training performance. An integrated model, based on results from the three cognitive subtests, was evaluated against flight training performance criteria.

Carretta, T. R. (1987). Basic attributes test (BAT) system: Development of an automated test battery for pilot selection. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

This report documents the development of the Basic Attributes Test (BAT) by the Air Force and provided some preliminary validation results. A detailed description is given of the BAT hardware and software, as well as descriptions of each of the tests that were currently part of the selection system when this report was written. Several personality measures were included in the system: (1) a Risk Taking test; (2) Self-crediting Word Knowledge Test (measures self assessment ability and self-confidence); (3) Activities Interest Inventory (measures survival attitudes); (4) the Embedded Figures Test (measures field dependence/independence); and (5) the

Automated Aircrew Personality Profile (measures personality factors that had not been determined at the time of the report). Preliminary results for the personality measures were not very encouraging, with only the Self-crediting Word Knowledge test shown to be predictive for either training outcome (pass/fail) or advanced training assignment.

Carretta, T. R. (1987). Basic Attributes Test (BAT) System: A Preliminary Evaluation. Brooks AFB, TX: Air Force Human Resources Laboratory.

Recent efforts to reduce attrition rates in Air Force Undergraduate Pilot Training (UPT) have resulted in the development of an experimental computer-administered test battery, the Basic Attributes Test (BAT) system. Included in the battery are several tests which measure information processing efficiency- and speed that were identified in previous research as being related to pilot performance, particularly with regard to fast jet fighter aircraft This paper evaluated three subtests used to assess cognitive abilities: Digit Memory (information input efficiency), Decision-Making Speed (low-level cognitive and high-level sensory perceptual-motor involvement), an Item Recognition (short-term memory storage, search and comparison operations). Each of the subtests was evaluated in terms of its ability to predict various flight performance measures and final training outcome. Of particular interest was the potential of the cognitive subtests to increase the validity of current selection procedures that rely mainly on paper-and-pencil measures. In addition, an integrated model containing both the current selection measure and experimental subtests did demonstrate significant relationships with several other performance measures including recommendations for fighter assignments after training.

Carretta, T. R. (1987). Field dependence-independence and its relationship to flight training performance. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Previous research has suggested that level of field dependence- independence could be used as a measure of social skills and vocational interests. According to this research, field-dependent individuals tend to prefer areas of work that require social skills, whereas field-independent individuals favor positions in the sciences or practical-analytical-oriented occupations. This study examined the usefulness of field dependence-independence measure for predicting performance during flight training. One thousand nine hundred seventy-seven (1,977) United States Air Force pilot candidates were administered the Embedded Figures Test as part of a computer-administered test battery prior to entry into Undergraduate Pilot Training (UPT). Several items on the Embedded Figures Test demonstrated poor reliability. Further, the level of field dependence-independence was not found to be related to performance during flight training. It was recommended that the test be eliminated for consideration as a selection and classification tool. Keywords: Job analysis; Flight crews.

Carretta, T. R. (1987). Spatial Ability as a Predictor of Flight Training Performance. Brooks AFB, TX: Air Force Human Resources Laboratory.

Spatial ability has been demonstrated to be related to Performance of a variety of tasks including several military enlisted jobs and piloting aircraft. This paper examined the relationship between performance on a spatial ability task (i.e., the Mental Rotation Test) and flight training performance for 1,939 United States Air Force Undergraduate Pilot Training (UPT) candidates. Performance on the Mental Rotation Test was not related to completion of training, but was related to a recommendation for specialized training after UPT. Pilot candidates who made quick, consistent, and accurate judgments were more likely to be recommended for

fast-jet training (Fighter-Attack-Reconnaissance or FAR). This was consistent with the current practice of selecting the best-performing student pilots for follow-on training in FAR aircraft.

Carretta, T. R. (1987). Time-Sharing Ability as a Predictor of Flight Training Performance. Brooks AFB, TX: Air Force Human Resources Laboratory.

Modern-day pilots must perform a variety of activities concurrently. In addition to flying the aircraft, they must monitor the communications channels and instrument panel and also navigate. As a result, the ability to allocate attention to different tasks effectively or "time share" is crucial for a safe, well-executed flight. A compensatory tracking and signal detection dual-task was administered to 1,130 United States Air Force pilot training candidates prior to entry into Undergraduate Pilot Training (UPT). Tracking performance was extremely reliable. Although performance on this task was not predictive of successful completion of UPT it was related significantly to a post-UPT advanced training recommendation. This task may be useful when it is desirable to place pilot candidates into specialized training tracks at an early point in training.

Carretta, T. R. (1988). *Cross-validation of an experimental pilot selection and classification test battery*. Paper presented at the 30th Annual Military Testing Association Conference, Arlington, VA.

Carretta, T. R. (1988). Relationship of encoding speed and memory tests to flight training performance. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

The demands on the cognitive/perceptual abilities of military pilots have increased steadily as aircraft have become more sophisticated. The ability to encode and classify signals and to retrieve information from short-term memory are two of the several cognitive/perceptual abilities that have been linked to flying performance. Two tests, Encoding Speed (encoding and classification ability) and Immediate/Delayed Memory (short-term memory retrieval), were administered to 2,219 United States Air Force pilot candidates prior to entry into Undergraduate Pilot Training (UPT). Performance on the Encoding Speed test was related to successful completion of UPT, in-flight performance measures, and advanced training assignment. However, scores on the Immediate/Delayed memory test were not related to training performance. Pilot candidates who made quick on accurate responses on the Encoding Speed test were more likely to perform well on in-flight performance measures and be recommended for post-UPT training in a fast-jet (Fighter-Attack-Reconnaissance) aircraft. Implications for pilot selection and classification are discussed.

Carretta, T. R. (1988). *USAF pilot selection and classification systems*. Paper presented at the Psychology in the Department of Defense Conference.

Carretta, T. R. (1989). *Recent Trends in USAF Pilot Selection and Classification Research*. Paper presented at the 31st Annual Military Testing Association Conference, San Antonio, TX.

Carretta, T. R. (1989). USAF pilot selection and classification systems. *Aviation, Space, and Environmental Medicine, 60*(1), 46-49.

The purpose of this study was twofold: (1) to identify research methodologies (i.e., the Basic Attributes Test; BAT) that add to the predictive validity of currently used pilot selection

procedures; and (2) to determine how accurately the recommendations made by the Advanced Training Recommendation Board (ATRB; fighter/non-fighter) could be duplicated without using flight training performance data. Four hundred seventy-eight USAF officer candidates from the AFROTC and OTS who had been tested on the BAT participated. Subjects had already been chosen for Undergraduate Pilot Training (UPT) based on their Air Force Officer Qualifying Test (AFOQT) scores. The AFOQT is a paper and pencil battery that consists of 16 subtests and produces five composite scores and the BAT consists of 12 computer-administered tests that measure psychomotor skills as well as a variety of cognitive abilities, perceptual abilities, personality and attitudinal characteristics. Three regression models were evaluated against UPT final outcome and ATRB recommendations: (1) Model I included AFOQT Pilot and Navigator-Technical composite percentile scores along with the number of times the AFOQT was taken by the subject; (2) Model 11 included scores from the BAT subtests; and (3) Model III combined the first two models. Results showed that Model I was significantly related to both UPT ($R = .17$, $p < .01$) and ATRB ($R = .17$, $p < .05$). Subjects who took the AFOQT only once were more likely to complete UPT successfully and to be recommended for follow-on training with fighter aircraft (FAR). The results for Model I1 showed that of the BAT tests, the two psychomotor skills tests demonstrated the strongest relationship to UPT ($R = .26$, $p < .01$), however, they were only marginally related to ATRB ($R = .16$, $p < .10$). The cognitive/perceptual abilities subtests were also significantly related to UPT and ATRB. For the personality/attitudinal subtests, results showed that those subjects who were more cautious on the test of self-confidence (Self-crediting Word Knowledge) and chose fewer high risk activities were more likely to complete UPT, but these tests were not related to ATRB. Finally, the results for Model III showed the strongest relationships to the criteria (UPT, $R = .50$, $p < .01$; ATRB, $R = .44$, $p < .05$), but some of the variables did not contribute at all. Thus, stepwise regression was used to develop a simpler model. The AFOQT scores were entered first, followed by the remaining 39 variables. The final model contained 11 variables from 8 different tests. These variables included the AFOQT, both psychomotor tests, 3 of the cognitive perceptual abilities tests (Encoding Speed, Item Recognition and Time Sharing) and 2 of the personality/attitudinal tests (S-CWK, AII) ($R = .31$, $p < .01$). The author recommends using AFOQT and BAT scores to both classify and select students for UPT and advanced flight training.

Carretta, T. R. (1990). Basic Attributes Test (BAT): A Preliminary Comparison Between Reserve Officer Training Corps (ROTC) and Officer Training School (OCS) Pilot Candidates. Brooks AFB, TX: Air Force Human Resources Laboratory.

The Basic Attributes Test (BAT) battery is a set of computer-administered personnel tests designed to assess a broad range of attributes believed to be related to flying training performance. The original battery consisted of 15 tests that measured psychomotor coordination, cognitive and perceptual abilities, and personality and attitudinal characteristics. This report focuses on the development of interim score profiles for eight of the BAT tests for Reserve Officer Training Corps (ROTC) and Officer Training School (OTS) pilot candidates. Comparisons between the two groups indicate that although the OTS group consistently scored higher on the Air Force Officer Qualifying Test (AFOQT) than did the ROTC group, the two groups scored very similarly on the BAT battery. A factor analysis was performed to provide insight into the ability domains assessed by the BAT battery. The six factors that emerged suggest that the eight tests are fairly independent. Finally, research regarding the utility of the

BAT battery for pilot selection and classification is reviewed briefly and suggestions are made regarding future development of the test battery.

Carretta, T. R. (1990). Cross-Validation of Experimental USAF Pilot Training Performance Models. Brooks AFB, TX: Air Force Human Resources Laboratory.

A series of studies have indicated that individual differences in hand-eye coordination, information processing ability, personality and attitudes are related to USAF pilot training performance. The current investigation was designed to cross-validate these results. Eight hundred eighty-five (885) USAF Undergraduate Pilot Training (UPT) students were divided randomly into two groups. Pilot selection models that used a combination of Air Force Officer Qualifying Test (AFOQT) and Basic Attributes Test (BAT) battery scores were developed independently for each group and then cross-validated with the other group. In the model development phase, subjects with good hand-eye coordination who made quick decisions were more likely to complete UPT successfully in both groups. Although there was some reduction in the validity coefficients in the crocs-validation phase, the selection models were related significantly to UPT final outcome in both groups. These results suggest that the AFOQT/BAT pilot selection models are sufficiently robust to be used as adjuncts to operational USAF pilot trainee selection procedures.

Carretta, T. R. (1991). Comparison of Experimental U.S. Air Force and Euro-NATO Pilot Candidate Selection Test Batteries. Brooks AFB, TX: Armstrong Laboratory.

Air Force personnel from several countries currently are evaluating computerized test batteries as an adjunct to current pilot candidate selection procedures. This paper describes and compares proposed U.S. Air Force (USAF) and Euro-NATO Aircrew Selection Working Group (ACSWG) pilot candidate selection test batteries. A validation strategy for the ACSWG test battery is described that focuses on test item analyses (e.g., evaluating internal consistency), evaluation of test scoring procedures, evaluation of test battery factor structure, and evaluation of test scores against training performance criteria.

Carretta, T. R. (1991). Short-term test-retest reliability of an experimental version of the BAT: AL Technical Report -1991-0001.

Carretta, T. R. (1992). Predicting pilot training performance: Does the criterion make a difference? Brooks Air Force Base, TX: Armstrong Laboratory.

The purpose of this study was to examine different procedures for generating performance criteria in order to: (a) reflect the relative quality of USAF pilot candidates based on flying performance scores and academic grades; and (b) evaluate the utility of these criteria for improving the understanding of the relationship between selection test scores and training performance. Seven hundred fifty-five USAF students between the ages of 21 and 31 years old who were completing Undergraduate Pilot Training (UPT) participated. Each subject had been administered the Air Force Officer Qualifying Test (AFOQT) and the Basic Attributes Test (BAT) prior to entry into UPT (subjects had already been chosen, in part, on the basis of their AFOQT scores). The AFOQT battery consists of 16 subtests that assessed 5 ability domains: verbal, quantitative, spatial, perceptual speed and aircrew interests/aptitude. Fourteen of the 16 subtests were used to compute the Pilot and Navigator-Technical composite scores used in the selection of pilot candidates. The BAT consists of 8 computerized tests that assessed individual

differences in psychomotor coordination (rotary pursuit, stick and rudder, compensatory tracking), information processing ability (reasoning, spatial transformation, short-term memory, perceptual speed), personality (self-confidence) and attitudes toward risk-taking. A variety of performance criteria were examined: (1) UPT final outcome (pass/fail); (2) academic grades; (3) daily flying grades; (4) check flight grades; and (5) number of flying hours. The Air Training Command (ATC) uses a weighted evaluation score based on three phases: Phase I (academic), Phase II (T-37, flying performance grades), and Phase III (T-38, flying performance grades). Several different equations were developed each dealing with the eliminees in a different way. Generally speaking, the rankling of the candidates was nearly identical for equations based on all of the criteria. For pilot training candidates, the criterion used did not make a difference as to who would have been selected. Additionally, alternative criteria demonstrated little utility for understanding the relationship between preselection personnel test scores and training performance. However, the rankings generated from the weighted evaluation scores were shown to be closely related to advanced training recommendations (fighter vs. nonfighter aircraft).

Carretta, T. R. (1992). Recent developments in U.S. Air Force pilot selection and classification. *Aviation, Space, and Environmental Medicine, 63*(12), 1112-1114.

This article discusses the implementation of a new system for classifying pilots. At the time this article was written, Air Force pilots were selected using a positively weighted composite of the following measures: the AFOQT pilot composite, composite psychomotor response speed scores from Mental Rotation (spatial transformation) and Item Recognition (short-term memory), tracking difficulty from Time Sharing, response speed and response choice from Activities Interest Inventory (attitudes toward risk) and previous flying experience. The Air Force had proposed to implement the Pilot Selection and Classification System (PSACS) which would change the process by which pilot candidates are selected and classified. The first plan was to replace Undergraduate Pilot Training (UPT) with Specialized Undergraduate Pilot Training (SUPT), which would classify pilot candidates into one of four major weapon systems categories (bomber, fighter, tanker or transport aircraft) using the AFOQT and the BAT. This plan was revised and classification into SUPT was to occur at the completion of T-37 training and be based on T-37 flying and academic performance, pilot candidate preferences and aircraft availability. The new plan included the Pilot Candidate Selection Method (PCSM), which includes the Pilot and Navigator-Technical AFOQT composites, BAT psychomotor scores, biographical information, information processing and personality measures. In a sample of 1,112 U.S. Air Force UPT students, the regression of these scores onto UPT final outcome (pass/fail) was .31. The author described this as a significant improvement in operational suitability. This system was scheduled to be operationally implemented by 1992.

Carretta, T. R. (1992). Short-term retest reliability of an experimental U.S. Air Force pilot candidate selection test battery. *International Journal of Aviation Psychology, 2*(3), 161-173.

Two hundred forty-seven U.S. Air Force pilot candidates commissioned through the Air Force Reserve Officer Training Corps were tested on an experimental form of the Basic Attributes Test (BAT) battery twice on consecutive days at the beginning of a flight screening program. The purpose of this study was to examine the short-term retest reliability of the BAT battery. There was a moderate correlation between subjects' first and second administration test composites (Pearson r = .56, Spearman r = .55). The magnitude of the retest correlations may

have been underestimated due to reduced test length and preselection of subjects on operational selection instruments. Implications for an operational retest policy and for a planned measurement and metric equivalency study are discussed.

Carretta, T. R. (1992). Understanding the relations between selection factors and pilot training performance: Does the criterion make a difference? *International Journal of Aviation Psychology, 2*, 95-106.

Carretta, T. R. (1995). *What is Measured and What is Predictive in USAF Pilot Selection Tests?* Paper presented at the 37th Annual International Military Testing Association Conference, Toronto, ON, Canada.

Carretta, T. R. (1996). *Air Force Officer Qualifying Test Retest Performance*. Paper presented at the 38th Annual International Military Testing Association Conference, San Antonio, TX.

The Air Force Officer Qualifying Test (AFOQT) is a multiple aptitude battery used to select applicants for U. S. Air Force (USAF) officer commissioning programs and to classify commissioned officers into aircrew training programs. Its factor structure has been studied (Carretta & Ree, 1996), it has been validated for pilot and navigator training (Arth, Steuck, Sorrentino, & Burke, 1990; Carretta & Ree, 1995a; Olea & Ree, 1994), and group differences have been examined (Carretta, in press; Carretta & Ree, 1995b; Roberts & Skinner, 1995). Current Air Force policy allows applicants to test twice on the AFOQT (one retest). The minimum retest interval is six months, but a retest may occur after several years. Additional retests can be and are granted, but require a waiver. Only the latest scores are reported to officer and aircrew selection boards and the boards are not informed whether the score is a retest. Although the current form (or its equivalent) of the AFOQT has been in use since 198 1, little research has been done to examine its retest characteristics (i.e., score changes, reliability, validity). Arth (1986) examined score changes and retest reliability for the operational composites in a sample of 2,246 USAF officer applicants. He observed that retesters‘ first-test scores were lower than those who tested only once. Arth also observed score gains for all composites and retest reliabilities between .775 and .880. However, he did not examine score changes or retest reliability for the 16 AFOQT tests, nor did he examine the predictive validity of first versus retest scores for pilot trainees. The purpose of this study was to examine retest mean score performance and retest reliability on the AFOQT composites and tests and to evaluate alternative methods for handling retest scores. Estimating the stability of test performance over time is important because it establishes an upper limit on the amount of agreement that can be expected on a retest and may provide insight about the interpretation of retest scores relative to first-test scores. Examining the predictiveness of first and retest scores may help to inform policy in the use of retest scores for pilot selection.

Carretta, T. R., Perry, D.C. and Ree, M.J. (1996). Prediction of situational awareness in F-15 pilots. *International Journal of Aviation Psychology, 6*(1), 12-41.

Carretta, T. R. (1996). Preliminary validation of several US Air Force computer-based cognitive pilot selection tests. Brooks Air Force Base, TX: Armstrong Laboratory.

Carretta, T. R. (1997). Group differences on U.S. Air Force pilot selection tests. Brooks Air Force Base, TX: Armstrong Laboratory.

Carretta, T. R. (1997). Group differences on US Air Force Pilot Selection Tests. *International Journal of Selection and Assessment, 5*(2), 115-127.

Carretta, T. R. (1997). Male-female performance on U.S. Air Force pilot selection tests. *Aviation, Space, and Environmental Medicine, 68*(9), 818-823.

Summarizes several studies of sex-differences in responses on Air Force pilot selection tests and in training performance. Reviews the predictive utilities of selection instruments and their ability structures and contribution of flying knowledge to training performance. Confirmatory factor analyses indicate that the same factors are measured for both sexes, although scores may be different. No evidence of predictive bias was found.

Carretta, T. R. (2000). U.S. Air Force pilot selection and training methods. *Aviation, Space, and Environmental Medicine, 71*(9), 950-956.

Changes in U.S. Air Force (USAF) pilot selection and training procedures have occurred in the last 5 years, including utilization of computer-based testing techniques to measure pilot aptitude. Training procedures have changed to provide more specialized training earlier in the training cycle. A recent study suggests that the information derived from testing is often ignored by pilot candidate selection boards. The largest sources of USAF pilot trainees rely on measures of officership for selection decisions. USAF pilot selection decisions could be improved by making better use of personnel attribute data. Further improvements could be gained from a structured selection interview and measures of personality.

Carretta, T. R. (2000). U.S. Air Force Pilot Selection and Training Methods. Wright-Patterson Air Force Base, TX: Air Force Research Laboratories.

Carretta, T. R. (2002). Common military pilot selection practices. *Gateway, XIII*(1), 1-4.

Carretta, T. R. (2005). Development and Validation of the Test of Basic Aviation Skills (TBAS).

In 1993, the Pilot Candidate Selection Method (PCSM) was operationally implemented as an adjunct to US Air Force pilot training selection methods. PCSM combined the Air Force Officer Qualifying Test (AFOQT) Pilot composite scores from the Basic Attributes Test (BAT) and a measure of prior flying experience in a regression-weighted pilot aptitude composite. Since 1993, neither the BAT hardware nor software have been updated. As with all aptitude tests, it is desirable to update test content at regular intervals to keep it current and avoid potential problems such as test compromise. In the case of computer-based tests such as the BAT, it is also desirable to update test hardware and software to avoid problems associated with normal wear to the system (e.g., calibration of the control sticks, functioning of input devices) and to take advantage of advances in computer hardware and software. The Test of Basic Aviation Skills (TBAS) was developed as a candidates BAT replacement test in the PCSM equation. The purpose of this report is to document the TBAS development process and report results of a study of its validity and incremental validity versus measures of pilot training performance when used with other operational measures of pilot aptitude (i.e., AFOQT), prior flying experience).

Carretta, T. R. (2006). Evaluation of Adverse Impact for US Air Force Officer and Aircrew Selection Tests. Wright-Patterson Air Force Base, OH: Air Force Research Laboratory.

Adverse impact issues have posed a challenge to military personnel selection. The purpose of the current study was to examine group differences in performance on tests used to qualify applicants for US Air Force officer commissioning and aircrew training programs. In particular, the impact of raising minimum qualifying scores on selection ratios for majority and minority groups was examined. Results indicated that strict application of the current minimum qualifying standards, along with top-down selection of qualified applicants, would lead to adverse impact for females and racial/ethnic minorities for both officer commissioning and aircrew training programs. Future test development should focus on the identification of tests that preserve the predictive validity of USAF personnel selection tests while minimizing subgroup differences. Reduction of adverse impact across all subgroups is a challenging issue. Sometimes changes in test content or the addition of a new test may reduce adverse impact for one subgroup but worsen it for another. Setting low minimum qualifying scores allows a greater range of applicants to be considered for training or job opportunities, but may adversely affect organizational performance (i.e., increase training requirements, reduce job performance). Minimum qualifying scores should be based on empirical research (e.g., job analysis) identifying the ability requirements for successful performance of the jobs being targeted.

Carretta, T. R., & Doub, T. W. (1998). Group differences in the role of g and prior job knowledge in the acquisition of subsequent job knowledge. Brooks Air Force Base, TX: Air Force Research Laboratory.

Carretta, T. R., & King, R. E. (2008). Improved military air traffic controller selection methods as measured by subsequent training performance. *Aviation, Space, and Environmental Medicine, 79*(1), 36-43.

INTRODUCTION: Over the past decade, the U.S. military has conducted several studies to evaluate determinants of enlisted air traffic controller (ATC) performance. Research has focused on validation of the Armed Services Vocational Aptitude Battery (ASVAB) and has shown it to be a good predictor of training performance. Despite this, enlisted ATC training and post-training attrition is higher than desirable, prompting interest in alternate selection methods to augment current procedures. The current study examined the utility of the FAA Air Traffic Selection and Training (AT-SAT) battery for incrementing the predictiveness of the ASVAB versus several enlisted ATC training criteria. METHOD: Subjects were 448 USAF enlisted ATC students who were administered the ASVAB and FAA AT-SAT subtests and subsequently graduated or were eliminated from apprentice-level training. Training criteria were a dichotomous graduation/elimination training score, average ATC fundamentals course score, and FAA certified tower operator test score. RESULTS: Results confirmed the predictive validity of the ASVAB and showed that one of the AT-SAT subtests resembling a low-fidelity ATC work sample significantly improved prediction of training performance beyond the ASVAB alone. DISCUSSION: Results suggested training attrition could be reduced by raising the current ASVAB minimum qualifying score. However, this approach may make it difficult to identify sufficient numbers of trainees and lead to adverse impact. Although the AT-SAT ATC work sample subtest showed incremental validity to the ASVAB, its length (95 min) may be problematic in operational testing. Recommendations are made for additional studies to address issues affecting operational implementation.

Carretta, T. R., & Ree, M. J. (1993). Basic Attributes Test (BAT): Operational pre-implementation analysis and score equating. Brooks Air Force Base, TX: Armstrong Laboratory.

Carretta, T. R., & Ree, M. J. (1993). Basic Attributes Test (BAT): Psychometric equating of a computer-based test. *International Journal of Aviation Psychology, 3*, 189-201.

Carretta, T. R., & Ree, M. J. (1993). Pilot Candidate Selection Method (PCSM): What Makes It Work? Brooks AFB, TX: Armstrong Laboratory.

A sample of 678 Air Force pilot training candidates were tested with a paper-and pencil aptitude battery and computer-administered tests of psychomotor skills, information processing, and attitude toward risk. A self report of flying experience was also collected. These data were used in regression analyses to determine which variables provided the best prediction of two flying criteria, passing-failing flying training and class ranking at the end of flying training. The paper-and-pencil tests were found to be the best predictors. The measures of flying experience, psychomotor skills, and altitude toward risk incremented the prediction of the criteria. Information processing was not found to be incremental to the other variables in the prediction of the criteria.

Carretta, T. R., & Ree, M. J. (1993). *Validity of the Air Force Officer Qualifying Test for predicting pilot training performance*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

The U.S. Air Force has used the same fundamental approach for the selection of pilots for over 35 years. Included among the selectors is the Air Force Officer Qualifying Test (AFOQT) which is comprised of 16 tests. Although the AFOQT has been used for officer commissioning and aircrew selection since 1957, few studies have examined its validity for predicting pilot training performance since 1966. The current study validated the AFOQT tests for five pilot training criteria. Subjects were 7,563 men and women selected for pilot training on the basis of educational attainment, academic major, and AFOQT scores. Criterion variables included daily flying grades and check flight grades in subsonic and transonic aircraft, and overall academic performance in the 53 week pilot training course. The criteria showed low to moderate correlations with each other. Test validities were presented in range-restricted form and were corrected for multivariate range restriction. The Arithmetic Reasoning test was most predictive of academic success. The Aviation Information and Instrument Comprehension tests were most predictive of daily and check flights in the initial jet aircraft. The Scale Reading test was most predictive for daily and check flights in the advanced training aircraft. The average validity of the tests in the operational composite used to select pilots was found to be .19 and the average of the eight most valid tests for pilot selection was .21.

Carretta, T. R., & Ree, M. J. (1994). Pilot-Candidate Selection Method: Sources of Validity. *International Journal of Aviation Psychology, 4*(2), 103-117.

Six hundred seventy-eight Air Force pilot training candidates were tested with a paper-and-pencil aptitude battery and computer-administered tests of psychomotor skills, information processing, and attitude toward risk. A self-report of flying experience was also collected. These data were used in regression analyses to determine which variables provided the best prediction

of two flying criteria: pass-fail flying training, and class rank at the end of flying training. The paper-and-pencil tests were found to be the best predictors. The measures of flying experience, psychomotor skills, and attitude toward risk incremented the prediction of the criteria above the prediction provided by the paper-and-pencil tests by 23%. Computer-administered information-processing measures were not found to be incremental to the other variables in the prediction of the criteria.

Carretta, T. R., & Ree, M. J. (1995). Air force officer qualifying test validity for predicting pilot training performance. *Journal of Business and Psychology, 9*(4), 379-388.

The AFOQT was validated for the prediction of pilot training criteria. Subjects were 7,563 men and women selected for pilot training on the basis of educational attainment and AFOQT scores. Criterion variables included daily flight training grades, check flight grades in subsonic and transonic aircraft, and overall academic performance in the 53 week pilot training course. Test validities were presented as observed, corrected for multivariate range restriction, and corrected for multivariate range restriction and unreliability. The Aviation Information and Instrument Comprehension tests, measures of job knowledge, were most predictive of daily and check flights in the initial subsonic jet aircraft. This reflects the relative greater importance of prior job knowledge early in training. The Scale Reading test, a measure of perceptual speed, was most predictive for daily and check flights in the advanced transonic training aircraft. The Arithmetic Reasoning test, a good measure of general cognitive ability, was most predictive of aeronautics in ground school. The development of an improved pilot selection composite is suggested by the results of the validity analyses.

Carretta, T. R., & Ree, M. J. (1996). Factor structure of the Air Force Officer Qualifying Test: Analysis and Comparison. *Military Psychology, 8*(1), 29-42.

The Air Force Officer Qualifying Test (AFOQT) is used to qualify men and women for commissions in the Air Force, classify them for pilot and navigator jobs, and award Reserve Officer Training Corps (ROTC) scholarships. Despite more than three decades of use, little published literature exists outside of Air Force technical reports, which do not receive wide distribution. One of the most important details about a test battery is which factors it measures. To determine this, several factor models were tested with structural equations. Most of the models were hierarchical with general cognitive ability (g) as the highest factor. A model with hierarchical g and the five lower order factors of verbal, math, spatial, aircrew, and perceptual speed fit the data best. The factor structure of the AFOQT was compared to the factor structure of the Armed Services Vocational Aptitude Battery (ASVAB), the enlistment qualification test battery. The AFOQT was found to contain a greater number of factors than did the ASVAB. Given the confirmed AFOQT factor structure, four methods of increasing its validity are proposed and discussed. These methods are increasing reliability of the tests, increasing the g saturation, adding job knowledge tests, and adding additional valid factors.

Carretta, T. R., & Ree, M. J. (1996). US Air Force pilot selection tests: What is measured and what is predictive? *Aviation, Space, and Environmental Medicine, 67*(3), 279-283.

Carretta, T. R., & Ree, M. J. (1997). The best retest is the average: Findings and implications. Brooks Air Force Base, TX: Armstrong Laboratory.

Carretta, T. R., & Ree, M. J. (1997). Expanding the nexus of cognitive and pyschomotor abilities. *International Journal of Selection and Assessment, 5*(3), 149-157.

A study was conducted to expand the nexus of cognitive and psychomotor abilities. A cognitive aptitude battery and a psychomotor battery were administered to 429 military recruits. A confirmatory factor analysis yielded higher-order factors of general cognitive ability (g) and psychomotor/technical knowledge (PM/TK). PM/TK was interpreted as Vernon's (1969) practical factor (k:m). In the joint analysis of these batteries, g and PM/TK each accounted for about 31% of the common variance. No residualized lower-order factor accounted for more than 7% PM/TK influenced a broad range of lower-order psychomotor factors. The first practical implication of these findings is that psychomotor tests are expected to be at least generally interchangeable. A second implication is that the incremental validity of psychomotor tests beyond cognitive tests is expected to be small. These findings should help guide test developers and inform personnel selecting agencies regarding the expected utility of psychomotor tests.

Carretta, T. R., & Ree, M. J. (1997). Factor Structures of the Air Force Officer Qualifying Test: Analysis and Comparison. Brooks AFB, TX: United States Air Force Research Laboratory.

Carretta, T. R., & Ree, M. J. (1997). Male and female causal models of pilot skill acquisition: A preliminary evaluation. Brooks Air Force Base, TX: Armstrong Laboratory.

Carretta, T. R., & Ree, M. J. (1997). Negligible sex differences in the relation of cognitive and psychomotor abilities. *Personality and Individual Differences, 22*(2), 165-172.

Comparisons of cognitive and psychomotor aptitude factor structure were made for samples of men and women. The factor model was previously confirmed. It included two higher-order factors representing general cognitive ability (g) and psychomotor/technical knowledge (PM/TK) as well as 10 lower-order cognitive and psychomotor factors. All cognitive and psychomotor tests contributed to the factor representing g. The PM/TK factor was interpreted as representing Vernon's (1969) practical factor (km). The model showed acceptable fit for both sexes. The proportion of total and common variance accounted for by the higher-order factors and lower-order factors were similar for men and women. Confirmatory factor techniques that imposed statistical constraints tested if the factor loadings were the same for both groups. Although some of the differences in loadings were statistically significant, they were small in magnitude (0.05 or less). The most notable differences occurred for the loadings of two technical knowledge tests on g and for a single psychomotor tests on PM/TK. All three tests had higher loadings for men than for women. Correlations between factor loadings for men and women approached r = I.P. These results are consistent with previous research supporting the near identity of ability structure for men and women.

Carretta, T. R., & Ree, M. J. (1998). Factor structure of the Air Force Qualifying Test: Analysis and comparison. Brooks Air Force Base, TX: United States Air Force Research Laboratory.

Carretta, T. R., & Ree, M. J. (1999). Pitfalls of ability research in aviation psychology. Wright-Patterson Air Force Base, TX: U.S. Air Force Research Laboratory.

Ability research in aviation psychology can be fraught with pitfalls that lead to

inappropriate conclusions . We identify several issues that lead to potential misinterpretation of results and suggest corrective solutions . These issues include lack of construct validity of the measures, misinterpretation of correlations and regression weights, lack of statistical power, failure to estimate cross-validation effects, and misinterpretation of factor analytic results.

Carretta, T. R., & Ree, M. J. (2000). Pilot Selection Methods. Wright-Patterson AFB, OH: United States Air Force Research Laboratory.

Carretta, T. R., Ree, M. J., & Callister, J. D. (1999). Factor Structure of the Cogscreen-Aeronautical Edition Test Battery. Brooks AFB, TX: United States Air Force Research Laboratory.

Carretta, T. R., Ree, M. J., Tsang, P. S., & Vidulich, M. A. (2003). Pilot selection methods. In P. S. Tsang & M. A. Vidulich (Eds.), *Principles and Practice of Aviation Psychology.* (pp. 357-396). Hillsdale, NJ: Lawrence Erlbaum Associates.

Carretta, T. R., Retzlaff, P. D., Callister, J. D., & King, R. E. (1998). A comparison of two U.S. Air Force pilot aptitude tests. *Aviation, Space, and Environmental Medicine, 69*(10), 931-935.

BACKGROUND: The Air Force Officer Qualifying Test (AFOQT) and Multidimensional Aptitude Battery (MAB) were administered to 2233 U.S. Air Force pilot candidates to investigate the common sources of variance in those batteries. The AFOQT was operationally administered as part of the officer commissioning and aircrew selection testing requirement. The MAB is a clinical test battery and was administered to provide an intellectual baseline to assist clinicians when it becomes necessary to evaluate pilots with cognitive referral questions. RESULTS: A joint factor analysis of the AFOQT and MAB revealed that each battery had a hierarchical structure. The higher-order factor in the AFOQT previously had been identified as general cognitive ability (g). The intercorrelation between the higher-order factors from the batteries was 0.981, indicating that both measured g. Although both batteries measured g and included verbal, spatial, and perceptual speed tests, the AFOQT also included tests of aviation knowledge not found in the MAB. CONCLUSION: Additional studies are required to evaluate the utility of the AFOQT for clinical assessment and the MAB for officer and aircrew selection.

Carretta, T. R., Retzlaff, P. D., & King, R. E. (1997). A tale of two test batteries: A comparison of the Air Force Officer Qualifying Test and the Multidimensional Aptitude Battery. Mesa, AZ: Armstrong Laboratory.

Carretta, T. R., Rodgers, M. N., & Hansen, I. (1993). The Identification of Ability Requirements and Selection Instruments for Fighter Pilot Training. Brooks AFB, TX: Armstrong Laboratory.

Forty-three experienced fighter pilots from Canada, Norway, and the United States served as subject matter experts (SMEs) in an effort to determine the relative importance of 27 personnel characteristics for fighter pilot performance. Inter-rater reliability estimates indicated an acceptable level of agreement for SMEs within each country and between pairs of countries regarding the relative importance of the 27 characteristics. Because there was sufficient

agreement among SMEs from the three countries, the average ranking of the 27 characteristics was calculated. Based on these results, aviation psychologists from Canada, Denmark, the Netherlands, Norway, United Kingdom, and the United States reviewed selection instruments currently in use in NATO member countries, to identify the most promising selection instruments for inclusion in a computer-based fighter pilot test battery. Their recommendations are summarized in the paper.

Carretta, T. R., & Siem, F. M. (1988). Personality, Attitudes, and Pilot Training Performance: Final Analysis. Brooks AFB, TX: Air Force Human Resources Laboratory.

Carretta, T. R., Siem, F. M., & Kantor, J. E. (????). *Selection and classification of Air Force pilot candidates.*

Carretta, T. R., & Walters, L. C. (1991). The Development of Behaviorally Anchored Rating Scales (BARS) for Evaluating USAF Pilot Training Performance. . Brooks Air Force Base, TX: Armstrong Laboratory.

The purpose of this study was to develop Behaviorally Anchored Rating Scales (BARS) which could be used by instructor pilots (IPs) to evaluate their students on eight personality characteristics considered important to flying fighter-type aircraft. IPs generated behavioral examples which reflected good, average, and poor job behaviors for each personality dimension. These job behaviors were randomized and presented to another group of IPs who tried to match each behavior with the personality characteristic it best represented. The IPs demonstrated sufficient agreement to develop BARS for four of the eight personality characteristics (achievement motivation, assertiveness, cooperativeness, and stress tolerance). The behavioral examples generated for the retained personality characteristics were evaluated for their use as scale anchor points. Several uses of BARS in the flying training environment were discussed.

Carretta, T. R., Walters, L. C., & Siem, F. M. (1991). *Personality assessment in proposed USAF pilot selection and classification systems*. Paper presented at the 6th International Symposium on Aviation Psychology, Columbus, OH.

These authors note that since 1955 the United States Air Force (USAF) has employed essentially the same basic approach to selecting pilot candidates. This paper describes proposed changes to this selection process. The two major changes in the system were: (1) converting from a generalized undergraduate pilot training WPT) system to a specialized undergraduate pilot training (SUPT) system; and (2) classifying candidates into one of two major weapon system categories (bomber/fighter or tanker/transport) after completing T-37 training. Broadly, this proposed Pilot Selection and Classification System (PSACS) consists of two types of methodologies. The first methodology relies on a computerized test device (the Basic Attributes Test [BAT]) to measure individual differences in hand-eye coordination, information processing ability, personality and attitudes. The BAT currently has four subtests that measure personality. Two of these tests (Self-crediting Word Knowledge and ABCD Working Memory) are considered cognitive ability tests that include performance-based personality measures (e.g., self confidence). The other two tests (Activities Interest Inventory and Aircrew Personality Profiler) are traditional self-report personality measures. These four personality measures have been shown to correlate significantly with UPT pass/fail scores, but they have not demonstrated any incremental validity over cognitive ability measures. The second methodology was a structured

interview developed by the Air Training Command (ATC) designed to collect three types of information: (1) background data (e.g., academic experience); (2) motivation and self confidence; and (3) job-related knowledge. These interview ratings have been shown to be significantly related to performance in a light aircraft, flight screening program.

Carretta, T. R., Zelenski, W. E., & Ree, M. J. (1997). Basic Attributes Test retest performance. Brooks Air Force Base, TX: Armstrong Laboratory.

Carretta, T. R., Zelenski, W. E., & Ree, M. J. (2000). Basic Attributes Test (BAT) Retest Performance. *Military Psychology, 12*(3), 221-232.

The Basic Attributes Test (BAT) contributes to a U.S. Air Force pilot selection composite known as the Pilot Candidate Selection Method (PCSM). When PCSM was operationally implemented in 1993, no retests were permitted on the BAT. To determine the effects of retesting on mean score change and reliability, the BAT was administered to 477 college students who were then retested after 2 weeks, 3 months, or 6 months. Several important findings were observed. First, about 70% of the students exhibited score improvement on retest, regardless of length of retest interval. Those who performed poorly on the 1st test generally exhibited larger improvements than those who performed well on the 1st test. Second, practice effects diminished as the length of the retest interval increased. For a 6-month retest interval, it was expected that the mean increase in PCSM scores would be about 6 percentile points. The results suggest that BAT retests could be permitted no less than 6 months after initial testing. Third, and very important, BAT scores demonstrated acceptable reliability. The reliability of the psychomotor composite ranged from .775 to .800, and the reliabilities for the other subtests ranged from .474 to .871.

Carson, L. D. (1948). Problems of flight personnel selection and training. *Military Surgeon, 103*, 32-36.

Carter, L. F. (Ed.). (1947). *Psychological Research on navigator training. Report No. 10*. Washington, DC: U.S. Government Printing Office.

Carter, L. F., & Dudek, F. J. (1947). The use of psychological techniques in measuring and critically analyzing navigators' flight performance. *Psychometrika, 12*, 31-42.

Cassie, A., Fokkema, S. D., & Parry, J. B. (1964). *Aviation psychology; studies on accident liability, proficiency criteria, and personnel selection*. The Hague,: Mouton.

Cattell, R. B. (1955). Psychiatric screening of flying personnel; personality structure in objective tests--a study of 1,000 air force students in basic pilot training. (Proj. No. 21-200202-0007. [Rep. No. 9]) (pp. 50): U.S. Air Force School of Aviation Medicine.

This battery of 50 group and 11 individual tests, yielding 124 separate scores, was administered to 1,012 aviation cadets and student officers on entering pilot training at Greenville Air Force Base, Miss., between April 1951 and July 1952. The composition and rationales of the tests and the results of 2 independently computed and rotated factor analyses, one on 500 cases and the second on 250 cases, are presented. 16 personality factors, matched in the 2 factorizations, were extracted and provisionally interpreted.

Chen, H.-C., Chien, P.-C., Cheng, C.-C., & Wu, J.-T. (2002). A cognitive approach to mental rotation testing on pilot selection. *Chinese Journal of Psychology, 44*(2), 227-238.

Cheng, C.-Y. (2005). *Predicting military flying training outcome using a computerised aptitude test battery*. Paper presented at the 47th Annual International Military Testing Association Conference, Singapore.

This paper presents the validation of RSAF's computerised aptitude test battery to flying training outcome. A sample of 990 pilot applicants were administered the battery of aptitude tests, and tracked until they completed flying training in a predictive model. Tests include hand-eye-foot coordination, system operations and reasoning. Multiple regression showed significance ($F(5,984) = 29.00$, $R^2 = .13$, $R = .36$, $p<.001$) of the composite in predicting pass/fail flying training. Norms were developed using standard deviation of the sample, leading to a classification system that included 6 bands. Expectancy tables were also developed based on the data, yielding a prediction of pass rate for each band of applicants. This allowed RSAF to monitor pilot output numbers more responsively, thus allowing for timely resource management.

Chidester, T. R., Helmreich, R. L., Gregorich, S. E., & Geis, C. E. (1991). Pilot personality and crew coordination: Implications for training and selection. *International Journal of Aviation Psychology, 1*(1), 25-44.

The performance of pilots can be construed as a product of skill, attitude, and personality factors. Although a great deal of effort within the aviation community has been focused on ensuring technical expertise, and new efforts highlight attitudes associated with crew coordination, personality factors have been relatively unexplored. Further, it is argued that past failures to find linkages between personality and performance were due to a combination of inadequate statistical modeling, premature performance evaluation, and/or the reliance on data gathered in contrived as opposed to realistic situations. The goal of the research presented in this article is to isolate subgroups of pilots along performance-related personality dimensions and to document limits on the impact of crew coordination training between the groups. Two samples of military pilots were surveyed in the context of training in crew coordination. Three different profiles were identified through cluster analysis of personality scales. These clusters replicated across samples and predicted attitude change following training in crew coordination.

Chidester, T. R., Kanki, B. G., Foushee, H. C., Dickinson, C. L., & Bowles, S. V. (1990). Personality factors in flight operations: Volume I. Leader characteristics and crew performance in a full-mission air transport simulation. Moffett Field, CA: NASA-Ames Research Center.

Chowdhury, U. (2005). Obsessive Compulsive Disorder: The Facts (3rd Edition). *Psychology, Health & Medicine, 10*(3), 315-316.

Christal, R. L. (1975). Personality factors in selection and flight proficiency. *Aviation, Space, and Environmental Medicine, 46*(3), 309-311.

Christen, B. R., & Moore, J. L. (1989). Descriptive analysis of ~~"n~~ot aeronautically adapted" in the U.S. Navy: 1989–1995. *Aviation, Space, and Environmental Medicine, 69*, 1071-

1075.

Clark, B., & Johnson, W. (1953). Previous education and age as related to grades in the U. S. Naval School, preflight. Pensacola, FL: Naval Aerospace Medical Institute.

Clark, B. S., & Johnson, W. (1952). The tests of the general educational development (College Level) as predictors of performance in the U.S. Naval School, pre-flight. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Clark, B. S., & Malone, R. D. (1952). The relationship of topographical orientation to other psychological factors in Naval aviation cadets. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Clark, B. S., & Malone, R. D. (1954). Topographical orientation in Naval aviation cadets. *Journal of Educational Psychology, 45*, 91-109.

Clark, B. S., & Nicholson, M. A. (1953). Aviator's vertigo: A cause of pilot error in Naval aviation students. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Clark, H. (1989). *Planned operational use of the Basic Attributes Test (BAT) system*. Paper presented at the 31st Annual Military Testing Association Conference, San Antonio, TX.
The Basic Attributes Test (BAT) system will be an essential element of the Pilot Selection and Classification System (PSACS) that Air Training Command (ATC) plans to have in place by the 3rd quarter of FY92 to support Specialized Undergraduate Pilot Training (SUPT). PSACS will improve ATC's ability to measure a pilot applicant's potential for successfully completing undergraduate pilot training and provide information that can be used for early aircraft category classification. With the acquisition of 135-200 BATS, ATC will start decentralized testing of all pilot applicants. The whole person concept will continue to be used by the selection and classification boards with BAT scores being a significant factor. Test scoring and processing will be centralized at a single location. ATC plans to make available time in its operational test battery for experimental tests in support of the Human Resources Laboratory's ongoing research.

Clark, J. B., & Riley, T. L. (2001). Screening EEG in aircrew selection: Clinical aerospace neurology perspective. *Aviation, Space, and Environmental Medicine, 72*(11), 1034-1036.

Clemens, N. A. (2005). Flying High: The Myth of Specificity. *Journal of Psychiatric Practice, 11*(2), 123-125.

Coco, M. P. (1991). *Pilot performance and biodata: There is a correlation!* Paper presented at the 33rd Annual Military Testing Association Conference, San Antonio, TX.
This study analyzes empirically keyed biodata derived from over 2000 military pilots who completed a self-report biodata survey containing over 600 variables. The primary purpose of this study, was to determine if biodata keys could predict military pilot performance. The analysis revealed twelve keys which demonstrated significant predictive power in both the

developmental and cross validation sample. The results of this study contributes significantly to validating biodata's predictive power in determining individual military pilot performance.

Cole, S. G., & Demarae, R. G. (Eds.). (1988). *Application of Interactionist Psychology: Essays in Honor of Saul B. Sells*. Hillsdale, NJ: Laurence Erlbaum.

Colvin, F. H. (1918). *Aircraft Mechanics Handbook: A Collection of Facts and Suggestions From Factory and Flying Field to Assist in Caring for Modern Aircraft*. New York: McGraw-Hill.

Committee on Selection and Training of Pilots. (1942). Historical Introduction to Aviation Psychology (Report No. 4). Washington, DC: Civil Aeronautics Administration, Division of Research.

Connelly, E. M., & Shipley, B. D. (1982). *Development of sensitive performance measures for selection of crews for flight training*. Paper presented at the 26th Annual Meeting of the Human Factors Society.

Performance of operator controlled systems is limited by our ability to measure system and component subsystem performance in a reliable and sensitive manner. Without adequate performance measures, there is no way to produce and test system designs, plan and execute training systems, or evaluate operational systems. Methods of developing these performance measures can be characterized by the way in which performance criteria are obtained. One approach which can be used when all factors that limit performance are known and quantified is an analytical method. For example, if a problem requires that an aircraft climb to a specified altitude while conserving fuel during the climb, the criterion, i. e., minimization of fuel, could be precisely defined analytically. Frequently, however, problems cannot be solved analytically, but demonstrations of superior as well as less than superior performances are available. In these cases an empirical approach can be used. This paper describes an empirical method for analyzing simulator flight data to develop weightings that permit performance discrimination between two groups of student pilots (one group of students successfully passed the initial Army rotary wing training program at Ft. Rucker, Alabama. The other group of students did not pass that training course.). The paper provides a description of the job sample (flight training) tests used to collect the data, the method for synthesizing the performance measures, and the results from using the measures to score student pilots.

Converse, E. V., & White, E. L. (1996) The history of officer social origins, selection, education and training since the eighteenth century: An introductory bibliography. *Special Bibliography Series*: United States Air Force Academy Library.

Cook, S. W. (Ed.). (1947). *Psychological Research on radar observer training. Report No. 12*. Washington, DC U.S. Government Printing Office.

Cooke, N. J., DeJoode, J. A., Pederson, H. K., Gorman, J. C., O'Connor, O. O., & Kiekel, P. A. (2004). The role of individual and team cognition in uninhabited air vehicle command-and-control. Arlington, VA: Air Force Office of Scientific Research.

Cooksey, A. M., Momen, N., Stocker, R., & Burgess, S. C. (2009). Identifying blood biomarkers and physiological processes that distinguish humans with superior performance under psychological stress. *PLoS One, 4*(12), e8371. doi: 10.1371/journal.pone.0008371

BACKGROUND: Attrition of students from aviation training is a serious financial and operational concern for the U.S. Navy. Each late stage navy aviator training failure costs the taxpayer over $1,000,000 and ultimately results in decreased operational readiness of the fleet. Currently, potential aviators are selected based on the Aviation Selection Test Battery (ASTB), which is a series of multiple-choice tests that evaluate basic and aviation-related knowledge and ability. However, the ASTB does not evaluate a person's response to stress. This is important because operating sophisticated aircraft demands exceptional performance and causes high psychological stress. Some people are more resistant to this type of stress, and consequently better able to cope with the demands of naval aviation, than others.
METHODOLOGY/PRINCIPAL FINDINGS: Although many psychological studies have examined psychological stress resistance none have taken advantage of the human genome sequence. Here we use high-throughput -omic biology methods and a novel statistical data normalization method to identify plasma proteins associated with human performance under psychological stress. We identified proteins involved in four basic physiological processes: innate immunity, cardiac function, coagulation and plasma lipid physiology.
CONCLUSIONS/SIGNIFICANCE: The proteins identified here further elucidate the physiological response to psychological stress and suggest a hypothesis that stress-susceptible pilots may be more prone to shock. This work also provides potential biomarkers for screening humans for capability of superior performance under stress.

Cooper, M. F., Imaye, S. M., Karre, R. H., Robertson, J. F., Ryan, M. E., & Sakahara, W. T. (1976). *Application of operational pilot selection criteria.* Air Command and Staff College, Maxwell Air Force Base, AL.

Cowan, D. K., Barrett, L. E., & Wegner, T. G. (1990). Air force officer training school selection system validation Brooks Air Force Base, TX: U.S. Air Force Human Resources Laboratory.

The present effort examined the selection process used for Air Force Officer Training School (OTS) candidates, with a view toward identifying and validating the component variables. In addition, the predictive validity of an experimental DTS selection algorithm was examined. Variables which were most highly related to selection decisions were examined for their relation to measures of performance in training and on the job. Criterion measures included: performance in OTS (instructor evaluations, final grade, completion, distinguished graduate); technical training school final grade; completion of Undergraduate Pilot Training; completion of Undergraduate Navigator Training; Officer Effectiveness Report ratings; and experimental measures of performance, motivation, and potential for career progression. It was concluded that (a) variables recommended by USAF Recruiting Service for OTS selection decisions are significantly related to selection outcome; (b) different predictor variables are related to selection for different occupational specialties; (c) there are significant differences among occupational specialties as to the extent to which selection decisions are predicted; (d) additional variables not examined here may influence selection decisions (e.g., narrative information contained in the applicant folder); (e) most of the variables recommended by USAF Recruiting Service for OTS selection decisions are significantly related to measures of performance in training and on the

job; (f) a few variables which are unrelated or negatively related to selection are related to some of the performance criteria (e.g., age, prior military experience, and letters of recommendation from military personnel); and (g) the experimental OTS selection algorithm was not effective in predicting either selection or performance.

Cowan, D. K., & Sperl, T. C. (1989). Selection and Classification of United States Military Officers: A Fifty-Year Bibliography (1937 - 1986): Air Force Human Resources Laboratory. Manpower and Personnel Division.

Cowels, J. T., Dailey, J. T., & Keller, R. J. (1951). Development of evaluative and predictive measures in the AF Officer Candidate School. Lackland AFB, TX: Air Force Personnel and Training Research Center.

Cowles, J. T., Dailey, J. T., & Keller, R. J. (1947). Development of evaluative and predictive measures in the AF Officer Candidate School. Lackland AFB, TX: Psychological Research and Examining Unit.

Cox, J. A. (1958). Factor analysis of experimental flexibility and reasoning tests administered to Air Force Academy cadets. Lackland Air Force Base, TX: Personnel Laboratory.

Cox, J. A., Jr., & Christal, R. E. (1956). Development and validation of the Pilot Instructor Selection Examination. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Cox, R. H. (1988). Utilization of psychomotor screening for USAF pilot candidates: Enhancing predictive validity. *Aviation, Space, and Environmental Medicine, 59*(7), 640-645.
Subjects for this research were 320 prospective pilots who were tested on computerized versions of the Two Hand Coordination (2HC) and Complex Coordination (CC) psychomotor tests. Independent variables included five basic error measures associated with the two tests, as well as seven new variables that had not previously been utilized. Results of MANOVA and multiple regression analyses revealed that performance on the two psychomotor tests were significantly related to Undergraduate Pilot Training (UPT) outcome. A trend was observed for a prediction model based on early and total trial data to yield higher simple and multiple correlations than a model based on late trials. Regressing the basic five independent variables on UPT outcome yielded R values of 0.334, 0.271, and 0.310 for early, late, and total trial data, respectively. The predictive validity of the basic five error scores was not incrementally increased by stepping in independent variables associated with the hypotenuse of horizontal and vertical error or stick movement. A stepwise multiple regression analysis revealed that the best two-variable prediction equation included the hypotenuse of horizontal and vertical error for both psychomotor tests (R = 0.329).

Cox, R. H. (1989). Psychomotor screening for USAF pilot candidates: selecting a valid criterion. *Aviation, Space, and Environmental Medicine, 60*(12), 1153-1156.

Coxwell, H. (1887). *My Life and Balloon Experiences*. London: Allen and Co.

Crawford, M. P., Sollenberger, R. T., Ward, L. B., Brown, C. W., & Ghiselli, E. E. (Eds.). (1947). *Psychological research on operational training in the continental air forces. Report No. 16*. Washington, D.C.: U.S. Government Printing Office.

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Creager, J. A. (1958). The 1958 experimental Air Force Academy Battery. Lackland Air Force Base, TX: Personnel Laboratory.

Creelman, J. A. (1954). An analysis of the physical fitness index in relation to training criteria in Naval air training. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Croft, D. B., & Christ, R. E. (1982). Evaluating the use of temporal-spatial patterns for personnel selection and classification. Bolling Air Force Base, DC: Air Force Office of Scientific Research.

Croll, P. R., Mullins, C. J., & Weeks, J. L. (1973). Validation of the cross-cultural aircrew aptitude battery on a Vietnamese pilot trainee sample. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Cross, K. D. (1997). Current State of Army Aviator Selection (pp. 83). Alexandria, VA: U.S Army Research Institute for the Behavioral and Social Sciences.

Crowley, J. C. (1989). Cerebral Laterality and Handedness in Aviation: Performance and Selection Implications. Brooks Air Force Base, TX: School of aerospace Medicine.

This paper reviews the general psychology literature related to handedness and cerebral laterality, beginning with a brief discussion of the research methods employed. Aspects of laterality, including vision, audition, tactile perception, spatial ability, and language are reviewed, as well as theories of cerebral dominance patterns. The handedness literature is examined, with attention to measurement, theories of genesis, sociocultural factors, and sex differences. There are many postulated correlates of human laterality, including performance, occupation, emotions, and various diseases. References, suggest that pilots who have no strong hand preference may be at a slight disadvantage in the cockpit, whereas those who are consistently right-side dominant tend to do well. Current neuropsychological theory would suggest that the ideal aviator brain' should be well lateralized, to minimize competition for hemispheric resources. There is evidence that pilots who are poorly lateralized may exhibit traits of right-left confusion. Several aircraft accidents have been attributed to pilots failing to correctly distinguish between left and right. Performance in flight school seems to be associated with right hemispheric (visuospatial) ability, as measured by tests of cognitive function. These tests have utility in the selection of aircrew; techniques for enhancing cognitive laterality may also prove useful.

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Da Rocha, U. (1929). Parte psychologica do relatorio dos trabalhos referentes a selecao de candidatos a avicao militar (Bases theoreticas e descriao dos methodos). *Ann. da Colon. de Psychopath., 2*.

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Dailey, J. T. (1951). Conference on revision of the aircrew classification battery. Lackland Air Force Base, TX: USAF Human Resources Research Center.

Dailey, J. T., & Gragg, D. B. (1949). Postwar research on the classification of aircrew. Alexandria, VA: USAF Human Resources Research Center.

Dale, D. (1986). Validation of the Micropat battery of pilot aptitude tests. In S. E. Newstead, S. H. Irvine & P. L. Dann (Eds.), *Human Assessment: Cognition and Motivation* (pp. 371). Dordrecht: Martinus Nijhoff.

Dale, H. C. A., & Bartram, D. (1984). *MICROPAT*. Paper presented at the 26th Annual Military Testing Association Conference, Munchen, FRG.

Dale, H. C. A., & Bartram, D. (1985). *MICROPAT*. Paper presented at the *26th Annual Military Testing Association Conference*, Munich.

Dale, H. C. A., & Bartram, D. (1985). *Micropat: A progress report on the validation of an automated test battery for pilot selection*. Paper presented at the 3rd Symposium on Aviation Psychology, Columbus, OH.

Dale, H. C. A., & Bartram, D. (1985). *Personality and the selection of military pilots*. Paper presented at the XVI Conference of the Western European Association for Aviation Psychology, Helsinki.

Damitz, M., Manzey, D., Kleinmann, M., & Severin, K. (2003). Assessment center for pilot selection: Construct and criterion validity and the impact of assessor type. *Applied Psychology: An International Review, 52*(2), 193-212.

Damos, D. (1982). The relation between the type A behavior pattern, pacing, and subjective workload under single- and dual-task conditions. [Research Note]. *Human Factors, 27*(6), 675-680.

Twenty Type A and 20 Type B subjects performed two discrete tasks alone and together. Half of the subjects performed paced versions of both tasks; half, unpaced versions. Workload ratings were obtained for all subjects under single- and dual-task conditions using eight bipolar adjective scales. Under single-task conditions there was a significant interaction between behavior pattern with pacing on one of the tasks. This interaction indicated that Type A subjects responded more rapidly under unpaced conditions than did Type 8 subjects, although there \Vas little difference between the groups under paced conditions. Under dual-task conditions, Type A subjects responded more rapidly than did Type B subjects regardless of pacing. There \Vas one significant interaction between behavior pattern and task on one of the workload scales.

Damos, D. (2007). Pilot job market and interview preparation (pp. Downloaded files used for the 2007 ISAP presentation on pilot selection and pilot hiring. They contain information on the hiring criteria of various air carriers February 2014, 2007.).

Damos, D. L. (1978). Residual attention as a predictor of pilot performance. *Human Factors, 20*, 435-440.

Sixteen student pilots performed a task combination designed to measure residual attention. Scores on this combination were correlated with performances on flight checks administered periodically during flight training. The multiple correlation between performances on the flight checks and the task combination increased as the students progressed through flight training. The usefulness of residual attention as a predictor of pilot performance is discussed.

Damos, D. L. (1993). Using meta-analysis to examine the predictive validity of single- and multiple-task measures to flight performance. *Human Factors, 35(4)*, 615-628.

The predictive validity of multiple-task measures (performance measures obtained when an individual performs two or more tasks concurrently) to flight performance has been frequently questioned because it is usually low and often appears to be no better than the validity of the corresponding single-task measures. Meta-analyses conducted on the results of 14 studies

demonstrated that the effect sizes associated with both single- and multiple-task measures were both statistically different from 0.0, with the effect size for the multiple-task measures statistically greater than that of the corresponding single-task measures. However, the corresponding predictive validities were low, and the usefulness of both measures is examined.

Damos, D. L. (1996). Pilot Selection Batteries: Shortcomings and Perspectives. *International Journal of Aviation Psychology, 6*(2), 199-209.

Presents the critical examination of pilot selection batteries. Prediction of training performance; Link of batteries between predictors and criterion; Suggestions for improving the predictive validity of the selection batteries.

Damos, D. L. (2001). Aiming for selection perfection. *Civil Aviation Training,* 25-28.

Damos, D. L. (2007). *Educational minimums and standardized intelligence testing in pilot screening and selection*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

Pilot shortages have resulted in changes in pilot screening and selection at air carriers. One of the widespread changes in the screening process is the use of low or no minimum educational requirement for pilot applicants. An informal survey of major and national air carriers revealed that few carriers require a college degree and many have no minimum educational requirement. The elimination or reduction of educational standards may result in changes in aptitudes in the applicant population. Two air carriers that did not require a college degree administered standardized intelligence tests to their pilot applicants. These data were compared to intelligence tests scores obtained from a sample of pilot candidates in the United States Air Force (USAF). The data from the air carriers showed a lower average full-scale IQ, a larger standard deviation, and a lower range of scores than the USAF data. Potential causes for these differences and their implications for training are discussed.

Damos, D. L. (2007). Foundations of military pilot selection systems: World War I. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Damos, D. L., Bittner, A. C., Kennedy, R. S., & Harneson, M. M. (1981). Effects of extended dual-task tracking performance. *Human Factors, 23*(5), 627-631.

A critical tracking task combination was examined for inclusion in an exotic environment test battery. Performance increased throughout 15 testing sessions despite the subjects' extensive prior tracking experience. However, consistent individual differences occurred only after Session 10. The implications of these results for research on exotic environments and timesharing abilities are discussed.

Damos, D. L., & Gibb, G. D. (1986). Development of a Computer-Based Naval Aviation Selection Test Battery (pp. 23). Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Damos, D. L., & Gould, R. B. (2007). Feasibility of developing a common U.S. Army helicopter pilot candidate selection system: Analysis of U.S. Air Force data. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Damos, D. L., & Koonce, J. M. (1992). Methodological and Analytical Concerns on the Pilot Selection Research of Park and Lee. *Human Factors, 39*(1), 9-13.

In 1992, Park and Lee published a paper in Human Factors on the use of a computerized battery to select pilots for the Korean Air Force. In the present article we describe problems associated with the selection, implementation, and administration of the tasks constituting the computerized battery in Park and Lee. Problems associated with the data analysis are also discussed and focus on factor interpretation and nonindependent statistical tests. We offer some general guidelines for developing computerized pilot selection batteries and data analysis.

Damos, D. L., & Lintern, G. (1979). A comparison of single- and dual-task measures to predict pilot performance. Bolling Air Force Base, DC: Air Force Office of Scientific Research.

Damos, D. L., & Lintern, G. (1980). *A comparison of the predictive validities of single- and dual-task measures.* Paper presented at the 24th Annual Meeting of the Human Factors and Ergonomics Society.

An experiment comparing the predictive validity of single- versus dual-task measures is reported. Fifty-seven males received two trials on each of two identical one-dimensional compensatory tracking tasks followed by 25 dual-task trials. Finally, they performed each task alone for one trial. The subjects then were given a short basic flight course consisting of ground instruction and practice in a GAT-2 simulator. After completing the course, the subjects performed four repetitions of three maneuvers. Performance in the simulator then was correlated with performance on each tracking trial. The predictive validity of the early single-task scores decreased with practice while the dual-task validity increased throughout the testing session. However, the predictive validity of the late single-task scores was almost as large as that of the late dual-task scores.

Damos, D. L., & Lintern, G. (1981). A comparison of single- and dual-task measures to predict simulator performance of beginning student pilots. *Ergonomics, 24*(9), 673-684.

Damos, D. L., & Smist, T. E. (1980). Individual differences in dual-task performance. New Orleans, LA: Naval Biodynamics Laboratory.

Damos, D. L., Smist, T. E., & Bittner, A. C. (1983). Individual differences in multiple-task performance as a function of response strategy. *Human Factors, 25*(2), 215-226.

This experiment demonstrates that the response strategies used to perform a discrete task combination reflect individual differences in multiple- but not single-task information processing. Subjects performed a discrete task combination on two consecutive days. On Day 1, the strategy was identified as a simultaneous, an alternating, or a massed response strategy. On Day 2, some of the subjects were asked to change strategy. Comparisons among subjects using the same strategy on Day 2 indicate that subjects who use the massed response strategy naturally do not perform as well under multiple-task conditions as do the other subjects, although their single-task performance is not significantly poorer. Subsequent analyses revealed that massed response subjects may have poorer time-sharing skills than other subjects.

Daniel, R. S., Eason, R. G., & Dick, R. D. (1957). A map-match method for the assessment of navigator performance in radar bombing: USAF Personnel and Training Research Center.

Dann, P. L., Irvine, S. H., & Collis, J. M. (Eds.). (1991). *Advances in Computer-Based Human Assessment* Dordrecht: Kluwer.

Danskine, W. B. (2001). *Fall of the Fighter Generals: The Future of USAF Leadership.* School of Advanced Airpower Studies, Maxwell Air Force Base, AL.

D'Arcy, S. H. (1987). [Brief on aptitude testing in the RAF].

Darr, W. (2009). A Psychometric Examination of the Canadian Automated Pilot Selection System (CAPSS). Ottawa: Director General Military Personnel Research & Analysis.

David, E. J. (1919). *Aircraft: Its Development in War and Peace and Its Commercial Future*. New York: Charles Scribner's Sons.

Davies, W. W. (1940). Some observations on aviation cadet selection. *Journal of Aviation Medicine, 11*, 37-42.

Davis, F. B. (1947). *The AAF qualifying examination. Report No. 6*. Washington, D. C.: U.S. Government Printing Office.

Davis, F. B. (1948). Problems in identifying the elements of pilot aptitude. *American Psychologist, 3*, 330-331.

Davis, F. B. (1948). Psychological research in the AAF Aviation Psychology Program. *Review of Educational Research, 18*(6), 543-574.

Davis, R. A. (1989). Personality: Its use in selecting candidates for US Air Force undergraduate pilot training. Maxwell Air Force Base, AL.

Davis, W., Koonce, J., Herold, D., Fedor, D., & Parsons, C. (1997). *Personality variables and simulator performance in the prediction of flight training performance*. Paper presented at the 9th International Symposium of Aviation Psychology, Columbus, OH.

Studied four different measures of tendency to provide internal feedback and BFITS total time to predict total number of hours to complete PPL. BFITS took 50 hours (avg.) and correlated 0.33 with total time.

De Bausset, A. (1887). *Aerial Navigation*. Chicago: Fergus Printing Company.

De Brauwer, B. (2001, May). American Airlines National status in a regional package. *Airline Pilot Careers,* 10-13.

De Guiche, A. D. G. (1918). *The Aviator's Pocket Dictionary and Table-Book*. New York: Brentano's.

Deighton, L. C. (Ed.). (1971). *Testing special groups: The armed forces.* New York: MacMillan

de Kock, F., & Schlechter, A. (2009). Fluid intelligence and spatial reasoning as predictors of pilot training performance in the South African Air Force (SAAF). *SA Journal of Industrial Psychology / SA Tydskrif vir Bedryfsielkunde, 35*(1). doi: 10.4102/sajip.v35ii.753

De Vries, P. B., Yaakimo, R., Curtin, J. G., & McKenzie, J. F. (1975). Undergraduate navigation training attrition study. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

de Wet, D. R. (1959). Coordination and floating effect. *Journal of the National Institute of Personnel Research, 8*, 28-38.

de Wet, D. R. (1960). An improved steadiness apparatus and its validity for air-pilot selection. *Journal of the National Institute of Personnel Research, 8*, 122-136.

de Wet, D. R. (1960). A portable hand-foot reaction test. *Journal of the National Institute of Personnel Research, 8*, 106-116.

de Wet, D. R. (1961). Handlebars: A self-paced test of two-hand co-ordination and some results on air-pilot candidates. *Journal of the National Institute of Personnel Research, 8*, 199-208.

Dean, B. J. (1996). *Aviation Selection Testing: The Effect of Minimum Scores on Minorities.* MS, Naval Postgraduate School, Monterey, CA.

Dean, J., Overton, R., Miller, R., Lankford, H., & Hughes, R. G. (1980). Specialized undergraduate pilot training: Tanker/transport/bomber (TTB) training requirements. San Diego, CA: Logicon, Inc.

A one-year contract effort was performed in response to the USAF Air Training Command Request for Personnel Research No. 75-27, 'Tanker/Transport/Bomber (TTB) Lead-In Training.' The effort accomplished the following: (a) identification of training requirements for the TTB phase of a proposed dual-track UPT program. These requirements cover those tasks which are common to the B-52, KC-135, C-130, C-141, C-9, and C-5 aircraft, (b) development of ways of estimating the training benefits to be derived by MAC and SAC from pilot lead-in training on these common tasks, (c) development of a method for determining the generalizability of any subset of TTB lead-in training tasks to the entire domain of TTB training tasks, and (d) development of an approach to the measurement of aircrew performance in the TTB training environment. This study effort was prerequisite to the Air Training Command development of a syllabus for the TTB track of a Specialized Undergraduate Pilot Training System (SUPTS).

Decker, W. R. (1988). *A model that uses psychomotor testing to predict naval aviator primary flight grades*. Masters Thesis. Naval Postgraduate School. Monterey, CA. With the costs of pilot training escalating, it is becoming increasingly important to make as few mistakes as possible in

the selection of potential aviators. In the early days of aviation the use of psychomotor testing played a big role in this selection process, but the physical complexities of the system caused its discontinuance. More recently, researchers at the Naval Aerospace Medical Research Laboratory, using micro-computers, have developed two new series of psychomotor tests. This thesis uses stepwise and multiple regression techniques to confirm the viability of using such a series of psychomotor tests to predict the flight grades of student aviators in primary flight school. The fitted regression model accounted for 77% of the variance in the primary flight grade data examined and appeared to be approximately 4.5 times better than the model currently used.

Deemer, W. L. (Ed.). (1947). *Records, analysis, and test procedures. Report No. 18*. Washington, DC: U.S. Government Printing Office.

Deemer, W. L., & Rafferty, J. A. (1948). Experimental evaluation of the psychiatric interview for prediction of success in pilot training. *Journal of Aviation Medicine, 20*, 238-250.

Defense Science Board. (2004). *Defense Science Board Study on Unmanned Aerial Vehicles and Uninhabited Combat Aerial Vehicles*. Washington, DC: Office of the Undersecretary of Defense for Acquisition, Technology and Logistics.

Deitcher, J. J., & Johnston, J. (2004). Investigating the use of alternate CAPSS sessions for pilot selection decisions. In A. P. Research (Ed.). Ottowa, ON: Chief of Air Staff.

Deitcher, J. J., & Johnston, J. (2004). Validation of the Canadian Forces Pilot Selection System. In A. P. Research (Ed.). Ottowa, ON: Chief of Air Staff.

Deitz, S. R., & Thoms, W. E. (1991). *Pilots, personality, and performance : human behavior and stress in the skies*. New York: Quorum Books.

Delaney, H. D. (1990). Validation of dichotic listening and psychomotor task performance as predictors of primary flight training criteria: highlighting relevant statistical issues: Naval Aerospace Medical Research Laboratory.

Delaney, H. D. (1992). Dichotic listening and psychomotor task performance as predictors of naval primary flight training criteria. *International Journal of Aviation Psychology, 2*(2), 107-120.

DeLucchi, J. R. (1942). Selection of military aircraft pilots: Our viewpoints about professional selection and psychological examination. *Journal of Aviation Medicine, 13*, 234-244.

Denihan, M. B. (2006). *Naturalistic decision making in aviation: Understanding the decision making process of experienced naval aviators during novel or unexpected situations in flight.* 66, ProQuest Information & Learning. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2006-99002-059&site=ehost-live

Department of Defense. (2005). *Unmanned Aircraft Systems Roadmap: 2005-2030*. Washington, DC: Department of Defense.

Department of Defense. (2009). *FY2009-2034 Unmanned Systems Integrated Roadmap*. Washington, DC: Department of Defense.

DeRivera, J. H. (1957). A note on the refinement of the pre-flight navigation grade when used as a predictor of flight failure. Pensacola, FL: Naval Aerospace Medical Institute, Naval Aerospace Medical Research Laboratory.

Devriendt, Y. A., & Levaux, C. A. (2003). *Validation of the Belgian military pilot selection test battery*. Paper presented at the 45th Annual International Military Testing Association Conference, Pensacola, FL.

For different reasons pilot selection is very important: the fast flying machines are difficult to handle, resources - such as gasoline - can be wasted, human incompetencies can cause serious damage and accidents. During the last decade budgetary restrictions have even made more important avoiding wasting resources. In the Belgian Defence Forces most of the pilot tests are computer-based and following Hilton and Dolgin (1991) the reality factor with regard to the working environment could be a catalyser for test predictivity. Nevertheless, more recently, increasing failure rates have led to call in question the effectiveness of the Belgian military pilot selection system. Psychologist were asked to conduct validity studies in order to replace bad performing tests. When training wastage is observed, it is not unusual to ask specialists to conduct validation studies, as Carretta and Ree (1997) report. Little is known about validity of the current Military Pilot Selection Battery (MPSB), due to a lack of interest for applied research matters from the side of policy makers and a shortage of large data sets. Until now there was no real psychotechnical tradition in the domain of pilot selection, but due to recent reorganisations and the creation of a General Directorate of Human Resources including a Research & Technology Department things may change for the better. In addition to the psychotechnical aspect there are technical and practical considerations to replace at least a part of the MPSB. The computer environment is an old computer setting. Spare-parts are becoming rare and expensive, and the programming languages will have to be adapted to meet modern standards. Furthermore, the pilot test battery will have to be dislocated in 2006, due to the policy to centralise all of the selection activities. The authors will give an overview of the procedures used to validate the MPSB and the results obtained. Procedures, results and areas of future research will be discussed.

Diaz, T., Ingerick, M., Fowler, R., & Lightfoot, M. A. (2004). Estimating Academic Attrition From Technical Training School Data: Method and Simulation Results (pp. 125). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Diaz, T., Ingerick, M., & Lightfoot, M. A. (2004). Replication of Zeidner, Johnson, and Colleagues' Method for Estimating Army Aptitude Area (AA) Composites (pp. 83). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Diaz, T., Ingerick, M., & Lightfoot, M. A. (2005). Evaluation of Alternative Aptitude Area (AA) Composites and Job Families for Army Classification. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Diepgen, R. (1999). Pilot selection in Germany: An example of some short-sighted arguments in psychological diagnostics. *European Review of Applied Psychology, 49*(3), 191-197.

Dille, J. R. (2000). Women in civil and military aviation: The first 125 years (1804-1929). *Aviation, Space, and Environmental Medicine, 71*(9), 957-961.

Dillinger, T. G., Wirgmann, D. A., & Taneja, N. (2003). *Relating personality with stress coping strategies among student pilots in a collegiate flight training program*. Paper presented at the 12th International Symposium on Aviation Psychology, Dayton, OH.

Aviation psychologists have long been interested in studying the personality characteristics of successful and safe pilots. To date, much of the research on pilot personality has involved the use of military aircrew. Few studies have examined the role of personality in civil aviation pilots‘ performance and stress coping during flight training. Therefore, little is known about the personality profiles of commercial and general aviation pilots, or the relationship between personality dimensions and the use of different strategies for dealing with flight-related stressors. Given the recurrent cutbacks in the U.S. military, an increasing number of commercial pilots in the U.S. are now being trained and recruited from the private sector rather than from the Armed Forces. Consequently, a better understanding of the personality profiles and stress coping strategies of pilots entering civil aviation training programs may help develop better selection, training, and safety programs for the civil aviation industry. To address these issues, we administered a personality test (Cattell, 1972) and a stress coping questionnaire (COPE) to first-year students (n=50) enrolled in the Professional Pilot Training program at the University of Illinois‘ Institute of Aviation. Results revealed that certain personality and stress-coping profiles of student pilots differed significantly from previously published norms within the population. Personality characteristics were differentially and significantly related to specific stress coping strategies adopted by student pilots. These findings support the notion that civil aviation pilots have different personality characteristics than non-pilots. In addition, they demonstrate that such differences can be associated with important stress coping strategies that may contribute to flight-training performance and success within civil aviation. Additional research is needed to increase the sample size used in this study and to track pilots‘ career performance long term.

Dillion, R. F. (Ed.). (1997). *Handbook on Testing*. Westport, CT: Greenwood Press.

Dillon, R. F., NewMyer, D., & Chambers, E. (1999). *Criterion Development in Pilot Selection*. Paper presented at the 41st Annual International Military Testing Association Conference, Monterey, CA.

Several significant efforts have been directed toward development of aptitude batteries for pilot selection (e.g., Johnston, 1996). The US Air Force has reported advances in the area (e.g., Tirre, 1996). At the collegiate pilot training level, the Flight Aptitudes Battery (e.g., Dillon & NewMyer, 1999) has been validated against performance in ground courses in beginning flight. The programs share many common measures of knowledge, skills, abilities, and other

attributes, and each program taps distinct attributes, such as information-processing abilities, temperament and leadership skills, or situational awareness (Dillon, 1996, in press). Bartram (1995) validated the Eysenck Personality Inventory (EPI) and Cattell's 16 Personality Factor Questionnaire (16PF) against flying training outcome. The author reports small but potentially valuable increments in validity when personality factors are used in selection for pilot training. Successful pilots are more likely to exhibit high levels of extraversion, emotional stability, independence, and toughmindedness than less successful pilots. Personnel selection or self-selection may yield consistent applicant profiles. Johnson and Blinkhorn (1994) underscore the importance of using job performance measures as criteria.

Dixon, S. R., Wickens, C. D., & Chang, D. (2005). Mission control of multiple unmanned aerial vehicles: A workload analysis. *Human Factors, 47*(3), 479-487.

With unmanned aerial vehicles (UAVs), 36 licensed pilots flew both single-UAV and dual-UAV simulated military missions. Pilots were required to navigate each UAV through a series of mission legs in one of the following three conditions: a baseline condition, an auditory autoalert condition, and an autopilot condition. Pilots were responsible for (a) mission completion, (b) target search, and (c) systems monitoring. Results revealed that both the autoalert and the autopilot automation improved overall performance by reducing task interference and alleviating workload. The autoalert system benefited performance both in the automated task and mission completion task, whereas the autopilot system benefited performance in the automated task, the mission completion task, and the target search task. Practical implications for the study include the suggestion that reliable automation can help alleviate task interference and reduce workload, thereby allowing pilots to better handle concurrent tasks during single- and multiple-UAV flight control.

Doane, S. (2003). New Measure of Complex Cognitive Abilities: Relating Memory Process to Aviation Flight Situation Awareness Abilities. Mississippi State, MS: Mississippi State University.

Doane, S. (2003). Relating Memory Processes to Aviation Flight Situation Awareness Abilities. Arlington, VA: Office of Naval Research.

Dobbins, D. A., Martinek, H., & Anderson, A. A. (1961). Inter- and intra-apparatus variance of psychomotor test scores of Army helicopter pilot trainees. Washington, DC: U. S. Army Adjutant General's Research and Development Command, Human Factors Branch.

Results reemphasized the need for caution in the use of psychomotor apparatus tests--individual differences in machines do occur, and scores tend to fluctuate significantly with continued use of the same machine. Solutions involving statistical conversion and proper maintenance of equipment are discussed.

Dockeray, F. C. (1920). *Department of Psychology.* Washington: Government Printing Office.

Dockeray, F. C., and Isaacs, S. (1921). Psychological research in aviation in Italy, France, England, and the American Expeditionary Forces. *Comparative Psychology, 1*(2), 115-148.

Dodge, R. (1910). The 'pendular whiplash illusion.'. *Psychological Bulletin, 7*(11), 390-394.

Dodge, R. (1913). The refractory phase of the protective-wink reflex: The primary fatigue of a human arc. *American Journal of Psychology, 24*(1), 1-7.

Dohme, J. A. (1979). *Assignment of Army aviator trainees to undergraduate aeroscout mission training*. Paper presented at the 21st Annual Military Testing Association Conference, San Diego, CA.

Dohme, J. A. (1979). Validation of the aeroscout selection process. Ft. Rucker, AL: U.S. Army Research Institute Ft Rucker Field Unit.

Dohme, J. A. (1981). *An evaluation of the fairness of the Flight Aptitude Selection Test (FAST)*. Paper presented at the 23rd Annual Military Testing Association Conference.

Dohme, J. A., Brown, W. R., & Sanders, M., G. (1982). Aviator selection research then and now. *U.S. Army Aviation Digest*, 24-29.

Dohme, J. A., Brown, W. R., & Sanders, M. G. (1981). An evaluation of the fairness of the Flight Aptitude Selection Test (FAST). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Dohme, J. A., Brown, W. R., & Sanders, M. G. (1982). Comparison of minority/majority attrition in the Army Initial Entry Rotary Wing Aviator course: Predicting graduation/elimination from FY 80 and 81 entry scores. Ft Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences.

Dohme, J. A., Brown, W. R., & Sanders, M. G. (1982). *Predicting attrition in the Army Initial Entry Rotary Wing Course*. Paper presented at the 24th Annual Military Testing Association Conference, San Antonio, TX.

Dolgin, D., & Gibb, G. D. (1988). Personnel assessment and aviation selection: Past, present, and future. In R. S. Jensen (Ed.), *Aviation Psychology* (3 ed., pp. 288-320). London: Gower.

Dolgin, D. L., & Gibb, G. D. (1988). A Review of Personality in Aviation Selection. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Dolgin, D. L., & Gibb, G. D. (1989). Personality assessment in aviator selection. Naval Air Station Pensacola, FL: Naval Aeromedical Research Laboratory.

A comprehensive review of personality literature as it relates to aircrew selection was conducted. the purpose of the study was to identify tests that warrant further research as potential prediction instruments. The advent of performance-based personality assessment and implications for future test development were examined. The majority of personality tests reviewed were invalid for pilot selection. Several tests appear to be both effective in pilot selection and psychometrically sound, and we recommend continued research of those. These

recommended selection tests include the Defense Mechanism test, the Personality Research form, and the Strong Vocational Interest Blank.

Dolgin, D. L., & Gibb, G. D. (1989). Personality assessment in aviator selection: Past, present, and future. In R. S. Jensen (Ed.), *Aviation psychology: The International Contribution* (pp. 285-319). London: Gower Publishing Co.

Dolgin, D. L., Gibb, G. D., Nontasak, T., & Helm, W. R. (1987). Instructor pilot evaluations of key naval primary flight training criteria. Naval Air Station Pensacola, FL: Naval Aerospace Medicine Research Laboratory.

Dolgin, D. L., Kay, G. G., Langelier, M. K., Wasel, B. D., & Hoffmann, C. (2002). Identification of the cognitive, psychomotor, and psychosocial skill demands of uninhabited combat air vehicle (UCAV) operators. *Space and Flight Equipment Journal, 30*, 219-225.

Dolgin, D. L., & Nontasak, T. (1990). *Initial validation of a personnel selection system for landing craft air cushion (LCAC) vehicle operations.* Paper presented at the Psychology in the Department of Defense12th Symposium.

Dolgin, D. L., Moore, J. L., & Ellis, S. A. (2001). *Aviator personality assessment: Part III—relevance to selection*. Paper presented at the Aerospace Medical Association Meeting, Reno, NV.

Dolgin, D. L., Shull, R. N., & Gibb, G. D. (1987). *Risk assessment and the prediction of student pilot performance.* Paper presented at the 4th International Symposium on Aviation Psychology, Columbus, OH.

D'Oliveira, T. C. (2003). Dynamic Spatial Ability & Ability to Coordinate Information: Predictive Contributions of Dynamic Spatial Ability and the Ability to Coordinate Information for Air Traffic Controller and Pilot Selection. *International Journal of Applied Aviation Studies, 3*(2), 227-241.

Doll, R. E. (1963). Officer peer ratings as a predictor of failure to complete flight training. *Aerospace Medicine, 34*, 16-17.

Doll, R. E. (1963). Peer rating validity as a function of rater intelligence and rating score received. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Doll, R. E. (1971). Early aptitude-achievement discrepancies as predictors of later voluntary withdrawal from Naval aviation training. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Doll, R. E. (1977). *Estimating the "true" validity of the naval aviation selection test battery.* Paper presented at the Scientific Meeting of the Aerospace Medical Association, Las Vegas, NV.

Doll, R. E. (1978). *A proposed selection system in Naval aviation.* Paper presented at the 2nd Annual Department of Defense Psychology Symposium, USAF Academy, Colorado Springs, CO.

Doll, R. E., & Baisden, A. G. (1979). A comparison of black civilian procured applicants and white civilian procured applicants for naval aviation training - CY 1976-1978. Naval Air Station Pensacola, FL: Naval Aerospace Medical Laboratory.

Dorfler, J. F. (1986). The Branch Point Study: Specialized Undergraduate pilot Training (pp. 117). Maxwell Air Force Base, AL: Airpower Research Institute.

Our next air battle may be in the hands of young men and women currently being trained as Air Force pilots. Properly classifying them as single-seat or multiengine pilots could give us the competitive edge in a future conflict and guarantee the air victory. This study examines the current Air Training Command pilot classification process and the outlook for the future. Before addressing future methods, Major Dorfler develops a historical perspective on pilot accession programs. A detailed account of the advanced training recommendation board process sets the stage for his analysis of current and future pilot classification methods. A realistic description of effectiveness versus economy adjusts the reader's perspective for specific, goal-oriented recommendations. Today's student pilot is a new breed of flier with different views and motivations--old classification methods must be tailored to meet future Air Force needs and to guarantee future air victories.

Downing, H. G. (2003). "We don't get much money, but we do see life" Letters of an airmen, 24 July-20 October, 1917. In J. E. Lewis (Ed.), *The Mammoth Book of Eyewitness World War I* (pp. 303-305). New York: Carroll & Graf.

Drasgow, F., Chernyshenko, O. S., Stark, S., Phillips, H. L., Phillips, J., Campbell, J. S., . . . Walker, P. (2009). *Scoring the Performance Based Measurement (PBM) Test to Enhance Naval Aviation Selection Decisions*. Paper presented at the 51st Annual International Military Testing Association Conference, Taru, Estonia.

The Performance Based Measurement (PBM) Test is an interactive computerized assessment that is being examined for inclusion in the U.S. Navy‘s web-based APEX.NET Aviation Selection Test Battery (ASTB). The PBM focuses on measuring skills and abilities related to cockpit performance, such as audio information processing, spatial orientation, physical dexterity, divided attention, task prioritization, and decision-making. Our paper describes findings regarding the scoring of the PBM and the relationships of subtest scores with criterion data collected as part of the Navy Pilot training program. Because several PBM subtests have shown good correlations with outcome variables, but quite low correlations with other indicators of cognitive ability, sizeable gains in predictive validity were anticipated when combining scores using a regression-based strategy. Results to date suggest that PBM subtest scores become increasingly important predictors as criterion variables become more closely aligned with actual flying tasks, thus supporting the use of this assessment for aviation selection decisions. Additional details on our analyses and the implications of these findings for practice will be discussed.

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Due to the high costs associated with military pilot training, it is imperative to select individuals with the highest probability of training success. The United States Air Force (USAF) utilizes Pilot Candidate Selection Method (PCSM) for selection. The PCSM algorithm predicts Undergraduate Pilot Training (UPT) performance and ranks candidates on the probability of success in UPT by combining scores from the Air Force Officer Qualifying Test and the Basic Attributes Test with a measure of flying experience. The purpose of this study was to determine the relationship between PCSM scores and the number of T-37 and T-38 flying training hours

required to complete UPT. The predominantly male sample consisted of 1,082 USAF officers who graduated from UPT between 1986 and 1992. The sample mean number of flying training hours was calculated for each aircraft training phase at the final checkride in the UPT syllabus. Each individual's cumulative flying hours at the last checkride were subtracted from the mean to determine how many "extra hours" each student pilot required. The correlations (corrected for range restriction) between PCSM scores and T-37 and T-38 extra hours were -.206 and -.270, respectively (pc.O5), indicating that UPT graduates with higher PCSM scores required fewer flying hours to complete training. The demonstration of the empirical relationship between PCSM and flying training hours provides the basis for estimating the training cost avoidance permitted by the use of PCSM in the selection of pilots.

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Makes a case that excessive emphasis has previously been placed on physiological attributes while psychological attributes have been underutilized. An analysis of actual attributes required leads to a set of aptitude tests. These include assessments of sensory sensitivities and reaction time. Something close to personality assessment is suggested for future development.

Edwards, A. (1996). Merryl David, naval aviator. *Essence, 27*(5), 56.
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Egan, D. E. (1978). Characterizing Spatial Ability: Different Mental Processes Reflected in Accuracy and Latency Scores. Naval Sir Station Pensacola, FL: Naval Aeromedical Research Laboratory.
Recent experimental studies have analyzed the time to perform tasks patterned after standard tests of spatial ability. Based on these analyses, information-processing models have been developed, suggesting that subjects work through a sequence of component mental

processes (e.g., code, transform, match) to perform spatial test items. If these models are correct, then response latencies, especially estimates of component-process durations, may be the best measures of spatial ability. By contrast, traditional psychometric analyses of these tasks have consistently used overall accuracy scores as measures of spatial ability. A model of the relationship between traditional accuracy measures of spatial ability and theoretically based latency measures is proposed. In this model overall accuracy and mean latency are viewed as composite scores consisting of the product (accuracy) or sum of latency) of component-process parameters. Three experiments investigated the relationship between spatial accuracy and latency scores, and established some psychometric properties (reliability, correlation across tests, predictive validity) of various measures. While accuracy and mean latency scores each proved to be reliable and consistent across different tests, the two measures were virtually independent. Further analyses using component process latency scores suggest that different mental processes influence overall accuracy and mean latency. One hypothesis consistent with the data is that spatial accuracy scores reflect the ability to accurately code a pictorial stimulus, but mean latency scores on the same items reflect the ability to mentally transform the code. Implications for ability testing are discussed.

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Elliott, S. (1997). *Some uses of personality testing in military aviation training*. Paper presented at the 39th Annual International Military Testing Association Conference, Sydney, Australia.

There has been a psychologist servicing RAAF Schools of Air Navigation and Air Traffic Control since 1990. The psychologist‘s role at these schools is to assess and counsel student problems, teach techniques for performance enhancement, particularly stress management techniques, provide input to instructor training courses, and conduct research to improve selection and training effectiveness. In support of this role, students have been routinely administered various personality measures, particularly the Myers Briggs Type Indicator (MBTI) and/or a Big 5 personality questionnaire (NEO-PI-R or NEO-FFI), as well as Niedeffer‘s Test of Attentional and Interpersonal Styles (TAIS) and the Osipow and Spokane Occupational Stress Inventory (OSI). The use of these measures in teaching students strategies for maximising performance is discussed, with some case studies. Descriptive data is presented for various measures, outlining how useful these are in predicting training outcomes.

Elliott, T. K., Joyce, R. P., & McMullen, R. L. (1979). The causes of attrition in initial entry rotary wing training. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

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Ellshaw, C. C., & Abram, C. M. (1997). *Personality and Met Expectations and the Prediction of Voluntary Wastage Amongst Officer Cadets*. Paper presented at the 39th Annual International Military Testing Association Conference, Sydney, Australia.

The paper examines the feasibility of improving the assessment of motivation among potential officer candidates at the Regular Commissions Board (RCB). There are three central issues: why do those deemed suitable for officer entry decide to leave voluntarily what can be done to predict voluntary wastage what other interventions are open to the organisation to influence the pattern of withdrawal? The reasons that underlie this problem are complex, however, recognising what influences the motivation of potential officers is central to improving the overall selection and training system. Given the complexity of the problem, the current report has been based on an extensive and detailed investigation of available research and has used a number of approaches to study the problem. Currently, a significant number of candidates withdrew from the selection process between RCB Briefing and the RCB and between RCB and entry to the Royal Military Academy Sandhurst (RMAS). Additionally, between 10-12% of RMAS main course cadets voluntarily withdrew from training (VWFT). Voluntary wastage is likely to become an increasing problem in the light of demographic trends, increasing recruiting targets and limits on recruiting resources. Considerable value exists in developing measures specifically designed to predict voluntary withdrawal. The study comprised an examination of exit reports and a large scale survey of 605 officer cadets. The analysis of training records was undertaken to examine reasons for VWFT amongst young officer cadets. The survey was targeted at various cross-sections of RMAS cadets. The survey aimed to explore a wide range of theoretical issues of potential value in predicting VWFT. The questionnaire also provided the opportunity to trial a number of potential personality measures (the Trait-Self Description (T-SD) inventory and the Locus of Control and Self efficiency scale). The results of this study strongly reflect the importance of realistic knowledge and expectations about initial officer training among Army applicants and the role of personality in adapting to the demands of Sandhurst life. VWFT appears to be less influenced by standard recruiting practices (e.g. advertising, familiarisation visits, recruiting officers etc.), or by provision of Sponsorship or other career opportunities at the point of selection. There is, however, a very clear relationship between expectations being met and the considering of withdrawal. The report supports the conclusion that RMAS training is more likely to be rejected by those who lack prior knowledge and experience of the military or organised group activities which provide similar experiences. The point between RCB and Sandhurst and the initial five weeks of training are likely to be the most significant times for influencing attitudes towards RMAS. There is strong evidence in the current report that officer cadets perceive a lack of adequate information prior to commencing RMAS. The evidence also indicates that cadets with lower scores on certain personality dimensions, namely, extroversion, conscientiousness and stability will tend to report the following: Fewer realistic briefs about training Poorer levels of coping behaviour Poorer level of _social fit' with other cadets Poorer understanding of their performance during training Poorer levels of commitment All these characteristics were found to predict expressed thoughts of voluntary withdrawal. The impact of training feedback and counselling is also likely to be of

crucial importance for those harbouring thoughts of leaving, especially in the early stages of training where most voluntary withdrawal occurs. Further understanding needs to be gained about how early socialisation influences impact on thoughts of leaving. For example, to what extent can aspects of officer training be adapted to develop those most likely to withdraw? However in order to explore this possibility RMAS would require some prior assessment by RCB of the risks of VWFT associated with each new cadet. The paper concludes the best predictors of VWFT would appear to be; personality measures, biodata, and a clear assessment of military compatibility.

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Investigates the influence of national and organizational cultures in determining selection systems for military aviators. Investigates the influence of national and organizational cultures in determining selection systems for military aviators. Benchmark on the consistent validity criterion stipulated in a research in 1989 by Hunter; Reference to World War II pilot selection methods in several countries; Comparison with two current pilot selection system.

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Farr, H. M. (1957). Procurement of Air Force officers during the period 1957 through 1977. Maxwell Air Force Base, AL: Air University, Air Command and Staff College.

Farr, R. W., & Kane, P. D. (2002). Clinical outcomes of naval aviation personnel with cholelithiasis. *Aviation, Space, and Environmental Medicine, 73*(7), 681-683.
BACKGROUND: This study examines the aeromedical outcomes of aviation personnel with asymptomatic cholelithiasis or those treated successfully with conventional (open) cholecystectomy (CC), laparoscopic cholecystectomy (LC), or extracorporeal shock wave lithotripsy (ESWL) for previous symptomatic cholecystitis. METHODS: The Biomedical Database of the Naval Aerospace Medical Institute was searched for waiver requests for asymptomatic gallstones, acute cholecystitis, and cholecystectomy. Microfiche records were then reviewed. The rates of development of symptomatic disease and need for cholecystectomy or ESWL were noted in aircrew granted waivers for asymptomatic cholelithiasis. The aeromedical outcomes of aircrew who underwent treatment for symptomatic disease by cholecystectomy (CC or LC) or ESWL were reviewed. RESULTS: A search of the Biomedical Database revealed waiver requests for cholelithiasis for 79 naval aviation personnel from April 1988 to August 2000. Waiver requests were for previous cholecystectomy in 56 (70.9%) and cholelithiasis in 23 (29.1%). No aviators had undergone ESWL. Of the 56 aviators with previous cholecystectomy, waivers were granted in 51 (91.1%) cases. Waivers were denied to five individuals, primarily for other medical problems. Of the 23 aviators with cholelithiasis, 11 (47.8%) were granted waivers. Waivers were denied in 12 aviators because of symptomatic cholelithiasis (5), asymptomatic cholelithiasis (1), common bile duct stone (1), other medical problems (3), or no explanation (2). The aviator with asymptomatic cholelithiasis and two of the aviators with symptomatic cholelithiasis were subsequently granted waivers after cholecystectomy (LC). The aviator with a symptomatic common bile duct stone received a waiver after cholecystectomy (CC). A total of 66 (83.5%) aviators received waivers. None were revoked during the study period because of symptomatic cholelithiasis or retained common bile duct stones. CONCLUSIONS: Aviation personnel who receive waivers for asymptomatic cholelithiasis or cholecystectomy rarely present with symptomatic biliary disease.

Farr, W. D. (1993). For want of a flight surgeon... *Aviation, Space, and Environmental Medicine, 64*(5), 405-408.
In 1863, Captain John Randolph Bryan conducted the Confederate States Army's first

military reconnaissance balloon flights. On his second flight, he survived a class "A" aviation mishap. This article discusses the probable contributing mishap factors stemming from the lack of an effective aviation medicine program with appropriate flight surgeon input and participation. Physical standards, flying duty medical examinations, the Acceptability Rating for Military Aeronautics (ARMA), crew rest regulations, unit safety programs, physiological training, aviation life support equipment (ALSE), night vision training, survival training, and aircraft accident investigation are explored.

Farrow, E. S. (1918). *A dictionary of military terms*. New York: Thomas Y. Crowell Company.

Fassbender, C. (1991). *Culture-fairness of test methods: Problems in the selection of aviation personnel*. Paper presented at the 6th International Symposium on Aviation Psychology, Columbus, OH.

This study examined cultural differences on several general aptitude and personality measures. The author notes that the international standardization of psychological selection tests, although very critical, can only be achieved if the selection methods employed are culturally fair. This study resulted from an attempt to develop norms for an English version of a psychological test battery, specifically focusing on two aspects of culture fairness: nationality and language differences. Subjects were scientists (15 women and 82 men) working in a variety of areas (e.g., Physics, Astronomy) in several different countries. The aptitude tests in this battery were presented in either a paper-and-pencil format or as apparatus tests, and were typical of most aptitude batteries (e-g., the battery measured attention, memory, psychomotor function, etc.). The personality inventory was the Temperament Structure Scales, which consists of 11 scales: motivation, emotional stability, rigidity, extroversion, aggressiveness, vitality, dominance, empathy, spoiltness, mobility and openness. In addition, the State Trait Anxiety Inventory and the Fear Survey Schedule (which measures phobic behavior and generalized anxiety) were administered. The results showed that there were significant differences in average scores obtained across nationalities (Northern Europe vs. Southern Europe) for scales from the FSS, the STAI, and for the openness scale of the TSS. An analysis of covariance revealed that there was a strong effect for knowledge of English and that nationality alone had only a negligible effect. The author discusses the implications of culturally biased tests for selecting aviation personnel.

Fassbender, C., & Goeters, K. M. (1992). Results of the ESA study on psychological selection of astronaut applicants for Columbus Missions I: aptitude testing. *Acta Astronautica, 27*, 131-138.

European participation in the Space Station Freedom brought about new challenges for the psychological selection of astronaut candidates, particularly in respect to specific demands of long duration space flights. For this reason existing selection criteria and methods were reassessed. On these grounds a study was undertaken applying a unique composition of aptitude tests to a group of 97 ESA scientists and engineers who are highly comparable to the expected astronaut applicants with respect to age and education. The tests assessed operational aptitudes such as logical reasoning, memory function, perception, spatial orientation, attention, psychomotor function, and multiple task capacity. The study goals were: 1) Verification of psychometric qualities and applicability of tests in a normative group; 2) Search for culture-fair tests by which multi-national groups can be examined; 3) Identification of test methods which consider general and special operational demands of long duration space flights. Based on the

empirical findings a test battery was arranged for use in the selection of ESA astronaut applicants. Results showed that 16 out of the 18 employed tests have good psychometric qualities and differentiate reliably in the special group of testees. The meta structure of the test battery as described by a factorial analysis is presented. Applicability of tests was generally high. Tests were culture-fair, however, a relation between English language skills and test results was identified. Since most item material was language-free, this was explained with the importance of English language skills for the understanding of test instructions. Solutions to this effect are suggested.

Fassbender, C., & Goeters, K. M. (1994). Psychological evaluation of European astronaut applications: results of the 1991 selection campaign. *Aviation, Space, and Environmental Medicine, 65*(10 Pt 1), 925-929.

In the summer of 1991, the European Space Agency (ESA) performed its second selection campaign since 1977 in order to find 10 astronaut candidates (laboratory specialists and space plane specialists). An integral part of this selection process was the psychological evaluation, according to the principles laid down in the study report "Definition of Psychological Testing of Astronaut Candidates." After national preselection, 59 applicants underwent the psychological evaluation, which consisted of the assessment of operational aptitudes (basic cognitive and psychomotor functions) and personality traits (motivation, social capability, stress resistance). The test program included a diverse number of tests, questionnaires, behavioral ratings, biographical data, and semi-structured interviews. About 50 scores were available for each subject. A comparison of the test scores with the original normative data, culture-fairness of the psychological selection, and discriminant functions analyzing the assessment decisions will be presented and discussed.

Fast, J. C., Stone, B. M., Cartagena, S., Zelenski, W. E., & Weeks, J. (1997). *Selection of United States Air Force Pilot Candidates*. Paper presented at the 39th Annual International Military Testing Association Conference, Sydney, Australia.

The objective of this project was to develop a methodology for predicting the selection scores for pilot and navigator candidates from three different commissioning sources and from active duty officer candidates. Each year the U.S. Air Force commissions officers from the US Air Force Academy (USAFA), Officer Training School (OTS), and Reserve Officer Training Corps (ROTC) detachments at major universities and colleges. From these officers, each commissioning source selects a number of candidates to be sent to pilot and navigator training. The USAFA convenes a board of commissioned officers to screen the records of all graduates who apply for this training and rank orders these candidates using a pilot and navigator board score. The OTS graduates who apply for this training are screened by an Air Force board to rank order candidates for selection. The ROTC candidates are rank ordered using a computer model. In addition, the these three sources, a fourth source of pilot and navigator candidates is a board which is convened by the Air Force Personnel Center (AFPC) to screen records of previously commissioned officers who have applied to be considered for future training slots. Each of these candidate selection sources were analyzed using the Policy Capturing methodology to attempt to predict the board scores for the USAFA, OTS, and AFPC selection boards. In addition, sources of bias in this selection process, such as sex and race, were investigated.

Federal Aviation Administration. (1996). *Advisory Circular: Pilot Records Improvement Act of*

1996.

This advisory circular (AC) provides information and standard forms, but not the only forms, that may be used to comply with some of the provisions of the Pilot Records Improvement Act of 1996 (PRIA), which is contained in Title V of Public Law 104-264, 110 Stat. 3259 (1996). The statute requires air carriers, prior to hiring an individual as a pilot, to request and receive: from the Federal Aviation Administration (FAA), certain records pertaining to the individual concerning pilot certificates, associated ratings, medical certificates, and summaries of legal enforcement actions; from other air carriers or other persons for whom the individual may have been employed in the past 5-year period, certain records pertaining to training, competency, disciplinary actions, and/or terminations or other causes for separation concerning the prior employee; and from the National Driver Register pertinent records concerning the motor vehicle driving record of the individual being considered for hiring. Note that this new statutory requirement only applies to those operators that have or are required to have an air carrier certificate. Further, air carriers that also conduct intrastate operations under Title 14 of the Code of Federal Regulations (14 CFR) parts 121 or 135 are required to comply with the new requirements.

Feggetter, A. J. W., & Hammond, D. (1975). The relationship between personality, flying aptitude and performance in rotary wing training. Farnborough: APRE.

Fehler, F. (1984). *Air-crew selection by means of a simulator-based testing system*. Paper presented at the 26th Annual Military Testing Association Conference, Munchen, FRG.

The development of a simulator-based selection system for the German army Aviation will be described. The task VIRS to use ordinary Uii-1 D simulators without any modification in soft- or hardware. Testing procedures had to be as simple as possible so as to make it possible for every instructor-pilot to run a subject through the program by simple following written instructions. Performance measurement had to be unambiguous and practical. A four-days-one-hour-per-day program was developed which leads flight naive subjects in 14 steps up to the handling of the simulator using pitch and stick while flying a complex maneuver (vertical-S) with all six degrees of simulator motion being active. Performance measurement is learning-objective oriented and highly objective. 44 subjects have been tested so far. All-subjects were able to handle the simulator with motion system on. Results vary over a wide range. A high degreed standardization among instructor pilots has been achieved. The system is ready for operation.

Fehler, F. (1990). *An Aviation Psychological System for Helicopter Pilot Selection and Training*. Paper presented at the 32nd Annual Military Testing Association Conference, Orange Beach, AL.

In Germany, aviation psychology looks back on an impressing history which had its beginnings way back in 1916 as some mythical accounts would have it. Although it is untrue that the late "Red Baron" made the acquaintance of aviation psychologists, it is certainly true to say that all German military pilots since the end of WW I have been confronted with aviation psychology in one way or another, if not with an actual aviation psychologist, then at least with aviation psychology methods and instruments. As a general rule, such instruments would include paper and pencil tests, and boxes with all kinds of levers, buttons, lights and bells. In the sphere of aviation, psychology was essentially synonymous with pilot candidate selection. Presumably

this is also true for other countries where aviation psychology is practiced. On the other hand, aviation psychologists were surprisingly hesitant in touching two other important areas of aviation, namely - pilot training - psychological support for aviators.

Feminier, D. (2000). Spoilt for Choice. *Civil Aviation Training,* 30-34.

Ferris, R. (1910). *How It Flies, or The Conquest of the Air: The Story of Man's Endeavors to Fly and the Inventions by Which He Has Succeeded*. New York: Thomas Nelson and Sons.

Finch, G. (1946). Modifications of the AAF S.A.M. pedestal sight manipulation test - and Appendix I. Wright-Patterson Air Force Base, TX: Air Material Command.

Finegold, L. S., & Rogers, D. (1985). Relationship between Air Force Officer Qualifying test scores and success in air weapons controller training. Brooks Air Force Base, TX: Air Force Human Resource Laboratory.

This project investigated the relationship between Air Force Officer Qualifying Test (AFOQT) composite scores and student performance in Air Force air weapons controller training. The purpose of this study was to examine the feasibility of using AFOQT scores as one of the selection criteria for entry to the air weapons controller field. A analysis of training performance data for 968 students showed a significant positive correlation between AFOQT Academic Aptitude composite scores and successful completion of training . Thus, a range of possible minimum cutoff scores on this composite was recommended as a selection criterion. Data concerning the appropriate cost of attrition rates (Fiscal Year 1982) for the five air weapons controller training organization and the expected effects of establishing various minimum selection criteria were also presented . A separate data analysis of demographic factors, including age, and source of commission showed no consistent relationship between these variables and student performance that would be useful in establishing criteria based on these variables . The decision to use AFOQT scores as one of the selection criteria is now under management review at Air Force Headquarters.

Finesinger, J. E., Cobb, S., Chapple, E. D., & Brazier, M. A. B. (1948). An investigation of prediction of success in Naval flight training. Washington, DC: Civil Aviation Administration.

Fiorino, F. (2002). Corporate culture fit "key" to pilot hiring. *Aviation Week and Space Technology, 157,* 56-58.

Fischer, S. C., & Mautone, P. D. (2005). Multi-Tasking Assessment for Personnel Selection and Development. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Fischer, W. E. (1998). *The Development of Military Night Aviation to 1919*. Maxwell Air Force Base, AL: Air University Press.

Fiske, D. W. (1946). Naval aviation psychology, III: The special services group. *American Psychologist, 1*, 544-548.

Fiske, D. W. (1947). Naval aviation psychology, IV: The central research groups. *American Psychologist, 2*, 67-72.

Fiske, D. W. (1947). Validation of naval aviation cadet selection tests against training criteria. *Journal of Applied Psychology, 5*, 601-614.

This article summarizes the work conducted by various government agencies to improve the selection of aviation cadets during the period around World War II. Three different predictors were tested using three different samples, each of whom joined the service under somewhat different circumstances (e.g., before or after the war). The first predictor was the Wonderlic Personnel Test (PT), which was later to become the Aviation Classification Test (ACT). It was a group-administered intelligence test (1 12 items) that tapped vocabulary, following directions, arithmetic reasoning, etc. The Mechanical Comprehension Test (MCT) was the second predictor and it is a 76-item test that measures knowledge of "barnyard physics." Finally, the Biographical Inventory (BI) was used, which has 150 items that measure background variables, interests, habits, preferences, etc. The BI and the MCT were later combined to form an overall Flight Aptitude Rating (FAR). This paper contains some of the first published validity data for these tests, which are still in use today (e.g., the BI and MCT). A variety of criteria were examined including training outcome (pass/fail) both for flight school and ground school, reason for failure in flight training and number of flight hours (although validities for number of flight hours are not reported). The validities for the PT were generally low across all three samples, although validities for predicting performance in ground school were moderately high (.20 to .3 1; sample sizes were very small; Ns ranged from 24-45). The validities of the MCT for predicting flight/ground school training were moderately high (ranging from -25 to .33 across the three samples). Finally, the BI did not predict ground school failures (or "Other Types of Failures") very well, but it did do a good job of predicting flight training failures (validities ranging from .29 to .34 across these samples).

Fitts, P. M. (1946). German applied psychology during World War II. *American Psychologist, 1*, 151-161.

Fitts, P. M. (Ed.). (1947). *Psychological Research on equipment design. Report No. 19*. Washington, DC: U.S. Government Printing Office.

Fitts, P. M. (1954). The information capacity of the human motor system in controlling the amplitude of movement. *Journal of Experimental Psychology, 47*, 381-391.

Fitzsimmons, P. J., McWhirter, P. D., Peterson, D. W., & Kruyer, W. B. (2001). The natural history of Wolff-Parkinson-White syndrome in 228 military aviators: a long-term follow-up of 22 years. *American Heart Journal, 142*(3), 530-536. doi: S0002-8703(01)18940-4 [pii] 10.1067/mhj.2001.117779

Wolff-Parkinson-White (WPW) syndrome poses a risk for tachyarrhythmias and sudden cardiac death. Most WPW studies have relatively limited numbers of subjects and brief follow-up periods. METHODS: We reviewed records of 238 consecutive military aviators with WPW syndrome evaluated from 1955 to 1999. Follow-up was by questionnaires, telephone interviews, or death certificates. Events included sudden cardiac death and supraventricular tachycardia

(SVT) (by electrocardiographic [ECG] documentation or suggestive symptoms). RESULTS: The mean age was 34.3 years (range 17-56 years). Forty-two (42/238, 17.6%) had SVT (WPW syndrome) and 196 of 238 (82.4%) had the WPW ECG pattern only. The mean follow-up of 21.8 years (range 2-41 years) was obtained on 228 of 238 (96%) for a total of 4906 patient-years. Sudden cardiac death occurred in 1 of 228, an incidence of 0.0002 per patient-year (95% confidence interval 0.0-0.001). SVT occurred in 47 of 228 (20.6%) or 0.01 per patient-year. One hundred eighty-seven (187/228, 82%) initially had the WPW ECG pattern only; 28 of 187 (15.0%) reported SVT during follow-up. Forty-one (41/228, 18%) initially had WPW syndrome; 19 of 41(46.3%) reported additional SVT during follow-up. CONCLUSION: Sudden cardiac death risk was low (0.02%/patient-year) in this WPW population. The SVT incidence was 1% per patient-year. Referral bias and some characteristics of the unique military aviator population may partly account for these low event rates. However, these results may be more applicable to unselected populations than are tertiary referral-based studies.

Flach, J., Eggleston, R., Kuperman, G., & Dominguez, C. (1998). SEAD and the UCAV: A preliminary cognitive systems analysis. Wright Patterson Air Force Base: Air Force Research Laboratory.

Flanagan, J. C. (1942). Psychological service in the U.S. Air Corps. *Journal of Consulting Psychology, 6*, 153-154.

Flanagan, J. C. (1942). The selection and classification program for aviation cadets (aircrew-bombardiers, pilots, and navigators). *Journal of Consulting Psychology, 6*, 229-240.

Flanagan, J. C. (1947). Psychological requirements of the airplane pilot. *Journal of Aviation Medicine, 18*, 521-527; 600.

Flanagan, J. C. (Ed.). (1948). *The aviation psychology program in the Army Air Forces. Report No. 1*. Washington, DC: U.S. Government Printing Office.

Flanagan, J. C. (1954). The critical incident technique. *Psychological Bulletin, 51*(4).
During the past ten years the writer and various collaborators have been engaged in developing and utilizing a method that has been named the "critical incident technique." It is the purpose of this article to describe the development of this methodology, its fundamental principles, and its present status. In addition, the findings of a considerable number of studies making use of the critical incident technique will be briefly reviewed and certain possible further uses of the technique will be indicated. The critical incident technique consists of a set of procedures for collecting direct observations of human behavior in such a way as to facilitate their potential usefulness in solving practical problems and developing broad psychological principles. The critical incident technique outlines procedures for collecting observed incidents having special significance and meeting systematically defined criteria. By an incident is meant any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act. To be critical, an incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer and where its consequences are sufficiently definite to leave little doubt concerning its effects. Certainly in its broad outlines and basic approach the critical incident technique has very little which is

new about it. People have been making observations on other people for centuries. The work of many of the great writers of the past indicates that they were keen observers of their fellow men. Some of these writers must have relied on detailed notes made from their observations. Others may have had unusual abilities to reconstruct memory images in vivid detail. Some may have even made a series of relatively systematic observations on many instances of a particular type of behavior. Perhaps what is most conspicuously needed to supplement these activities is a set of procedures for analyzing and synthesizing such observations into a number of relationships that can be tested by making additional observations under more carefully controlled conditions.

Flanagan, J. C., & Pitts, P. M. (1944). Psychological testing program for the selection and classification of air crew officers. *Air Surgeon Bulletin, 1*(6), 1-5.

Fleischman, H. A., Ambler, R. K., Peterson, F. E., & Lane, N. E. (1966). The relationship of five personality scales to success in Naval aviation training. Pensacola, FL: Naval Aerospace Medical Institute, Naval Aerospace Medical Research Laboratory.

Fleischman, H. L., Ambler, R. K., Peterson, F. E., & Lane, N. E. (1966). The Relationships of Five Personality Scales to Success in Naval Aviation Training. Naval Air Station Pensacola, FL: Naval Aerospace Medical Institute.

Fleishman, E. A. (1953). An evaluation of two psychomotor tests for the prediction of success in primary flying training. Lackland Air Force Base, TX: U.S. Air Force Human Resources Research Center.

Fleishman, E. A. (1953). A factor analysis of intra-task performance on two psychomotor tests. *Psychometrika, 18*, 45-55.

Fleishman, E. A. (1954). Evaluations of psychomotor tests for pilot selection: The direction control and compensatory balance tests. Lackland Air Force Base, TX: U.S. Air Force Personnel and Training Research Center.

Fleishman, E. A. (1954). A factorial study of psychomotor abilities: USAF Personnel and Training Research Center.

Fleishman, E. A. (1956). Psychomotor selection tests: Research and application in the United States Air Force. *Personnel Psychology, 9*, 449-467.

Fleishman, E. A. (1957). Factor structure in relation to task difficulty in psychomotor performance. *Educational and Psychological Measurement, 17*, 522-532.

Fleishman, E. A. (1975). Toward a taxonomy of human performance. *American Psychologist, 30*, 1127-1147.

Fleishman, E. A., & Hempel, W. E. (1953). Changes in factor structure of a complex psychomotor test as a function of practice. Lackland Air Fore Base, TX: USAF Human Resources Research Center.

Fleishman, E. A., & Hempel, W. E. (1954). Changes in factor structure of a complex psychomotor test as a function of practice. *Psychometrika, 19*(3), 239-252.

Scores obtained at eight different stages of practice on the Complex Coordination Test together with scores on 18 reference tests were subjected to a Thurstone Centroid Factor Analysis. Nine meaningful factors were identified in the experimental battery. The results indicated considerable, but systematic, changes in the factor structure of the Complex Coordination Test as practice on the task was continued. The test became less complex (factorially) as practice was continued. Moreover, there was a change in the nature of the factors contributing variance at early and later stages of practice. Implications of the findings are related to certain problems of learning theory, psychomotor test development, and criterion analysis.

Fleishman, E. A., & Hempel, W. E. (1954). A factor analysis of dexterity tests. *Personnel Psychology, 7*, 15-32.

Fleishman, E. A., & Hempel, W. E. (1955). The relation between abilities and improvement with practice in a visual discrimination task. *Journal of Experimental Psychology, 49*, 301-312.

Fleishman, E. A., & Hogan, J. C. (1978). A taxonomic method for assessing the physical requirements of jobs: The physical abilities analysis approach. Washington, DC: Advances Research Resources Organization.

Assessing work requirements across the universe of job classifications represents a major problem confronting those responsible for personnel decisions. The dimensions on which work vary are numerous, insufficiently defined, and complicated by continuous automation and job redesign. In some cases, the establishment of dimensions, categories, or grouping of job requirements is an arbitrary process originating from practical necessity rather than from systematic empirical or then ethical rationale. It is clear that the absence of a complete taxonomic structure of human work classification reduces the effectiveness of personnel decisions regarding success of an individual worker within the demands of the job.

Fleishman, E. A., & Ornstein, G. N. (1960). An analysis of pilot flying performance in terms of component abilities. *Journal of Applied Psychology, 44*, 146-155.

Fleishman, E. A., & Rich, S. (1963). Role of kinesthetic and spatial-visual abilities in perceptual-motor learning. *Journal of Experimental Psychology, 66*, 6-11.

Fleming, T. O. (1980). Pilot specialists--the potential for dual-track personnel management of U.S. Air Force pilots. Leavenworth, KS: U.S. Army Command and General Staff College.

Flight Safety Foundation. (1948). *Scientific methods for use in the investigation of flight crew requirements*. Woods Hole, Mass.

Flyer, E. S., & Bigbee, L. R. (1954). The light plane as a pre-primary selection and training device, III: Analysis of selection data. Lackland Air Force Base, TX: U.S. Air Force

Personnel and Training Research Center.

Flyer, E. S., & Bigbee, L. R. (1955). Estimates of the validity of the AFOQT pilot aptitude score for an AFROTC sample. Lackland Air Force Base, TX: Personnel Research Laboratory.

Flyer, E. S., & Bigbee, L. R. (1955). Light plane proficiency ratings as a selection device for AFROTC pilot trainees. Lackland Air Force Base, TX: Personnel and Training Research Center.

Flyer, E. S., & Bigbee, L. R. (1955). Primary flying grades, pilot stanines, and preflight peer nominations as predictors of basic pilot training. Lackland Air Force Base, TX: Personnel and Training Research Center.

Flyer, E. S., & Bigbee, L. R. (1955). Primary flying grades, pilot stanines, and preflight peer nominations as predictors of basic pilot training criteria. Lackland Air Force Base, TX: U.S. Air Force Personnel and Training Research Center.

Flyer, E. S., & Bigbee, L. R. (1955). Validity of AFOQT aptitude and interest scores as predictors of AFROTC pilot training success. Lackland Air Force Base, TX: Personnel Research Laboratory.

Flynn, C. F., & King, R. E. (1994). Using Computerized Neuropsychological Testing to Assess Aviator Skills. Brooks AFB, TX: Armstrong Laboratory.

Flynn, C. F., Sipes, W. E., Grosenbach, M. J., & Ellsworth, J. (1994). Top performer survey: Computerized psychological assessment of aircrew. *Aviation, Space, and Environmental Medicine, 65*, 39-94.

Flynn, J. A. (1989). *Validation Model: Canadian Forces Cognitive Pilot and Navigator Selection Tests*. Paper presented at the 31st Annual Military Testing Association Conference, San Antonio, TX.

The cognitive paper and pencil tests known as the Aircrew Aptitude Test Battery (AATB), currently being used for pilot and navigator selection at the CF Aircrew Selection Centre (CFASC), are becoming dated. These tests were developed to meet selection requirements during World War II (Ferguson & Sloan, 1954; Knoll, 1950; Noble & Manning, 1948), later validated for Canadian use (Lockwood, 1965; McInnis, 1965), and more recently, psychometric characteristics were examined in James (1986). Though proving successful as an aircrew selection measure over the years, the tests are based on the traditional requirements of aircraft systems operating almost fifty years ago. There are a number of reasons for updating the current aircrew selection test battery. Contemporary aircraft have become increasingly sophisticated, with technological advances resulting in the automation of many functions previously performed by aircrew. However, the complexity of modern aircraft, which utilize advanced visual displays and computer technology, place significantly higher cognitive workload and information processing demands on aircrew. Furthermore, new testing methods have been introduced since the AATB was first used. It is desirable that these new methodologies be employed in the design and evaluation of the new tests. During the l970s, the

US Air Force Human Resources Laboratory developed and tested an experimental cognitive test battery designed to improve the selection of aircrew officers. The tests that showed promise as good predictors of pilot (Hunter & Thompson, 1.978) and navigator (Valentine, 1977) training performance were introduced at CFASC in early 1983 as the Experimental Aircrew Selection Battery (ASB-X). A French- language version of the ASB-X was developed and experimentally introduced at the CFASC in 1984. The ASB-X, comprised of eight multiple-choice tests, is administered to CFASC aircrew candidates as part of their regular selection processing.

Flynn, J. A. (1990). Psychometric evaluation and validation of the air traffic controller aptitude test. Willowdale, Ontario: Canadian Forces Personnel Applied Research Unit.

The Air Traffic Controller Aptitude Test (ATCAT) has been used since 1985 as an experimental Air Traffic Control (ATC) selection measure. This paper presents the history , content and previous research on the ATCAT and related U.S. test on which the ATCAT is based. Item level data was gathered on 155 students and criterion data was obtained for 1.12 students who completed the ATC course . As was expected from U.S. research , psychometric analysis revealed that the ATCAT is a highly speeded test with upwardly biased reliability measures . The test operates similarly for both anglophone and francophone groups. Validation analyses produced non-significant results for the anglophone and combined groups. The francophone correlation was unexpectedly significant; however, this was found to be due to the effects of the ATC Technical Vocabulary Course. It was recommended that the experimental use of the ATCAT he discontinued. A new ATC measure, the Terminal Option Controller Test (TOCT), has been identified and will be introduced as an experimental selection measure. Strategies to increase validation sample size will be explored.

Forlano, G., & Watson, G. B. (1937). Relation between success in military training and intelligence, extroversion, and adequacy. *Journal of Social Psychology, 8*, 243-249.

Foster, G. W., & Moses, F. L. (2004). Instructor's and researcher's manual: A way to train future small unmanned aerial vehicle operators. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Fournier, B. A., & Stager, P. (1976). Concurrent validation of a dual-task selection test. *Journal of Applied Psychology, 61*(5), 589-595.

Fowler, B. (1981). The aircraft landing test: An information processing approach to pilot selection. *Human Factors, 23*(2), 129-137.

The Aircraft Landing (AL) test is a pilot selection device in which attempts are made at simulated approaches and landings of an aircraft on a runway until a criterion skill level is achieved. The test was designed with principles from the information processing model of skilled performance in mind, and two concepts from the model were tested: hierarchical mechanisms and feedback. Using Canadian Forces pilot trainees, validities up to 0.45 (n = 104, no previous flying experience) and 0.49 (n = 26, previous flying experience) were obtained against a criterion score based on flying tests at 7 and 12 h in a light aircraft. It was concluded that the practical utility of the test was highly satisfactory and that its validity could be increased by modifications. The pattern of results provided some support for the theoretical predictions from the information processing model, but methodological difficulties prevented a clear-cut interpretation.

Advantages of this approach over an abilities model are discussed.

Fowler, R. D. (2005). Flying High and Flying Low. *PsycCRITIQUES, 50*(14).

This is a review of the Martin Scorsese motion picture, The Aviator. This motion picture is a biographical treatment of Howard Hughes in the narrow time frame of 1928 to 1946. It emphasizes his developing psychological disorders along with his innovations in aviation.

Fracker, M. L. (1991). Measures of situation awareness: Review and future directions. Wright-Patterson Air Force Base, OH: Armstrong Laboratory.

Measures of situation awareness (SA), or what operators know about their immediate situation, are reviewed. Three major approaches to SA assessment are considered: explicit, implicit, and subjective rating. Explicit measures require operators to self-report material in conscious memory. Implicit measures assess the influence of relevant events on subsequent task performance. Subjective ratings require operators to assign numerical values to the self-assessed quality of their SA. These three measurement approaches are evaluated in terms of their reliability and three kinds of validity: construct, content, and criterion. Several problems requiring further research are identified and discussed . In particular, reliability and content validity continue to present serious difficulties, some of which suggest that new approaches to SA measurement may still be needed.

Fracker, M. L. (1991). Measures of situational awareness: An experimental evaluation. Wright-Patterson Air Force Base, OH: Armstrong Laboratory.

Both explicit and implicit measures of situation awareness (SA) were evaluated in a series of experiments in order to assess their reliability and two kinds of validity: criterion and construct. In all of the experiments, subjects performed a simulated combat task in which they had to monitor the positions of enemy, friendly, and neutral objects. In addition, subjects had to attack and defend themselves against enemy objects. A memory probe procedure was used to explicitly assess two components of SA: location and identity awareness. In addition, a signal detection analysis was used to provide an implicit measure of SA. Test-retest correlations indicated that the location awareness measure was much less reliable than the others. Criterion validity was evaluated by correlating the SA measures with probability of a kill in the combat task. Although the SA metrics seemed to be fairly good predictors of kill probability, the best predictor was a measure of behavioral workload. Predictions of multiple resource theory were used to evaluate construct validity. In particular, it was predicted that difficulty in maintaining identity awareness would not affect location awareness, and this prediction was largely supported. Nevertheless, other aspects of the data seemed to contradict current versions of multiple resource theory.

Fracker, M. L., & Davis, S. A. (1991). Explicit, implicit, and subjective rating measures of situation awareness in a monitoring task. Wright-Patterson Air Force Base, OH: Armstrong Laboratory.

The situation awareness (SA) and mental workload of 56 subjects were evaluated as they monitored one or more attributes of six objects moving systematically over a rectangular grid. Subjects were assigned to one of seven groups depending upon whether they were to monitor object locations (location task), object colors (color task), whether the objects flashed (flash task), or some combination of these three . Both task performance and subjective ratings were

used to assess subjects' awareness of the three object attributes. In addition, subjective ratings of mental workload were collected . All subjects performed the monitoring task under four different conditions formed from the factorial combination of 1) the probability that objects of a certain color would flash and 2) whether object colors remained consistent or changed during the course of a trial. The results pointed to the usefulness of both flash and color task performance as measures of SA. Subjects were very poor at the location task, suggesting either their location awareness was poor or the location task is not a good measure of that awareness . Subjective ratings proved useful but occasionally dissociated from task performance . One possibility is that subjective ratings reflect rational inferences b the subjects rather than the outcome of their introspections.

Frank, L. H., & Baisden, A. G. (1993). *The 1992 Navy and Marine Corps aviator selection test battery development*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

This paper briefly describes the development and content of the 1992 revision of the Navy and Marine Corps Aviation Selection Test Battery (ASTB). The ASTB is the primary instrument for selecting personnel into the student naval aviator (pilot) and student naval flight officer (navigator) program for the U. S. Navy, U. S. Marine Corps, and the U. S. Coast Guard. The first Naval aviation selection test was implemented in 1942 with revisions occurring in 1953 and 1971. Specifics of these early versions have been documented elsewhere (Griffin & Mosko,1977; North & Griffin, 1977; Baisden & Holcombe, 1991) and will not be addressed here. In 1984 a program was begun to revise the Naval aviation selection test. There were five primary reasons for initiating a new test: (1) changes in the demographics of the applicant population (e.g., an all volunteer force, educational curricula); (2) changes in Naval aviation training (e.g., increased use of simulators) and operational aircraft (e.g., glass cockpits); (3) possible compromises in the test since its revision 13 years earlier; (4) decreased predictive validity; and (5) changes in federal guidance regarding employee selection procedures.

Franzen, R., & Blaine, L. (1944). Evaluation of respiratory measures for use in pilot selection. Washington, DC: Civil Aviation Administration Division of Research.

Fretz, G. (2001). Nice 'n' easyJet does it. *Civil Aviation Training,* 24-27.

Fretz, G. (2004). A new reign in Spain. *Civil Aviation Training,* 16-19.

Fretz, G. (2005). Cathay Pacific Jewel of the East. *Civil Aviation Training,* 8-12.

Frey, B. F., Thomas, M. J. W., Walton, A. J., & Wheeler, P. J. (2001). *WOMBAT as an example of situational awareness testing in pilot selection: An argument for the alignment of selection, training and performance*. Paper presented at the 11th International Symposium on Aviation Psychology, Columbus, OH.

Situational Awareness (SA) is considered essential to safe and expert pilot performance. The computer-based WOMBATTM test provides a multi-tasking environment designed to assess a set of abilities thought to be important for the maintenance of SA in complex environments. There is some evidence to suggest that performance on this test is related to elite pilot performance. This paper reports the results of a study assessing the predictive validity of the test

with regard to the training performance of ab-initio pilot students. Performance measures included official Flight Test scores as well as the number of flight hours to criterion performance. An analysis of data provided by approximately 30 student pilots was undertaken. The results did not support the position that WOMBAT scores have predictive validity in relation to the employed criterion variables. However, situational awareness data derived from a subsequent simulator study did show the expected relationship. The results of these studies are discussed with respect to the theoretical and practical considerations pertaining to selection, training and performance. Consequent recommendations center around the alignment of selection, training and performance measures. It is argued that the use of detailed and explicit developmental markers can result in both a robust means of assessing predictive validity and increased efficiency and effectiveness of flight training.

Froom, P., Cyjon, A., Lotem, M., Ribak, J., & Gross, M. (1988). Aircrew selection: a prospective study. *Aviation, Space, and Environmental Medicine, 59*(2), 165-167.

Fry, G. E., & Reinhardt, R. F. (1969). Personality characteristics of jet pilots as measured by the Edwards personal preference schedule. *Aerospace Medicine, 40*, 484-486.

The authors state that much data has been collected on the student military aviator, but significantly less attention has been focused on the operational military pilot. This study compared the performance of three groups (jet aviators, a general population normative sample and a normative group of college-educated males) on several psychological tests. Of 298 pilots reporting to several Carrier Replacement Air Wing squadrons, 288 participated. Subjects completed a personal history questionnaire, the Maudsley Personality Inventory and the Edwards Personal Preference Schedule (EPPS). None of the inventories are described in any detail in the article. The jet aviator group differed significantly from the EPPS General Adult Male norm group on all scales except Intraception. This group differed significantly from the EPPS College Male norm group on all scales except for Need for Achievement and Exhibition. The EPPS has also been given to several classes of student flight surgeons and, with a few conceptually meaningful exceptions, the pilots in this study tended to score similarly to the student flight surgeons. The differences were that the student flight surgeons scored higher on Nurturance and lower on Dominance. As compared to the general male population, the jet aviators scored higher on the Heterosexuality, Dominance, Change, Achievement and Exhibition scales and lower on the Nurturance, Abasement, Deference, Order and Succorance scales.

Fuchs, E. F. (1978). Fairness evaluation. Final Report on Purchase Order DAHC19-77-M-0010.

Fuhrmann, L. J. (1977). *Beyond human limitations*. Pittstown, N.J.: Columbia Pub. Co.

Fulkerson, S. C. (1956). Adaptability screening of flying personnel: Development of a preliminary screening battery. Brooks Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Fulkerson, S. C. (1957). Adaptability screening of flying personnel: Research on the Minnesota Multiphasic Personality Inventory. Brooks Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Gal, R., & Mangelsdorff, A. D. (Eds.). (1991). *Handbook of Military Psychology*. New York: Wiley & Sons.

Garrad, M. (1997). *Computer Aided Text Analysis in Pilot Selection: A Criterion Revisited*. Paper presented at the 39th Annual International Military Testing Association Conference, Sydney, Australia.

One of the pivotal contributions of Military Psychology to improving military personnel selection has been the development and utilisation of structured, objective tests of ability and aptitude. In contradistinction to the cognitive domain, until recently there has been little success in the application of non-cognitive constructs to the selection of pilots. Researchers have suggested that less intrusive measures than those currently employed may be required to assess the ‗deeper' aspects of the non-cognitive domain, such as the "dark side" of personality. In this paper, data from a study of a novel application of Computer Aided Text Analysis (CATA) to the selection of RAAF pilot trainees is further investigated. Given previous findings that suggest CATA has the potential to be a useful tool in pilot selection, this study elaborates reasons for pilot training failure beyond the bivariate pass/fail criterion previously employed. The use of a bivariate pass/fail criterion introduces the potential for attenuation of prediction given the possible inclusion of failures for cognitively based reasons. In this study, the training suspension reports (TSR's) were manually content analysed and "failure themes" extracted. The TSR's were encoded and results subjected to a Principal Components Analysis to determine if a latent component structure could be observed. From the component structure matrix a number of scores were calculated for each applicant. Themes extracted from a 20 minute communication skills essay were then used to investigate subsequent pilot training performance. The results hold relevance for the use of CATA as a military selection tool, specifically for pilot and more generally as a means of assessing non-cognitive domains in personnel selection.

Garvin, J. D., Acosta, S. C., & Murphy, T. E. I. (1995). *Flight training selection using simulators--a validity assessment*. Paper presented at the 8th International Symposium on Aviation Psychology, Columbus, OH.

Gates, T., Duffy, K., Moore, J., Howell, W., & McDonald, W. (2007). Alcohol screening instruments and psychiatric evaluation outcomes in military aviation personnel. *Aviation, Space, and Environmental Medicine, 78*(1), 48-51.

Alcohol-related disorders are the most prevalent psychiatric conditions in the aviation population. Efforts to effectively screen aviators for these disorders are continually sought, as under-diagnosis may negatively impact aviation safety. This study evaluates screening tools that have been validated in non-aviators in terms of their utility for aviator patients. Methods: There were 111 male aviation patients (27 ± 7 yr) referred for psychiatric evaluation at the Naval Aerospace Medicine Institute who completed the Self-Administered Alcohol Screening Test (SAAST), the Alcohol-Use Disorders Identification Test (AUDIT), and the Common Alcohol Logistical Scale-Revised (CAL-R) prior to evaluation by a staff psychiatrist or psychologist. Results: There were 40 patients who were qualified psychiatrically with no diagnosis and 49 patients who were disqualified for psychiatric reasons due to a non alcohol-related diagnosis. The remaining 22 patients were disqualified for psychiatric reasons with an alcohol-related diagnosis. The optimal aviator cut-off scores were consistent with those of the general population, although the cut-off score used for the SAAST was set at the published sub-threshold

level to provide greater sensitivity. The sensitivity/specificity values for the SAAST, AUDIT, and CAL-R were 59%/94%, 46%/96%, and 68%/81%, respectively. Conclusion: The psychometrically sophisticated CAL-R is sensitive, specific, and has good negative predictive value, although its use requires a psychologist and its availability is limited. The SAAST and AUDIT can be administered by a flight surgeon or aviation medical examiner (AME). Given the higher sensitivity of the SAAST it may be the most beneficial if administered first. The AUDIT can be used as a follow-up diagnostic test given its higher specificity.

Gayler, W. K. (2000). *Aviator Inexperience.* MA, U.S. Army Command and General Staff College, Fort Leavenworth, KS.

Geist, C. R., & Boyd, S. T. (1980). Personality characteristics of Army helicopter pilots. *Perceptual and Motor Skills, 51*(1), 253-254.

This study used the Minnesota Multiphasic Personality Inventory (MMPI) to compare the scores of 15 male Army helicopter pilots to 16 male non-pilot Army officers. Differences in mean standard scores obtained by these two groups on the MMPI scales were compared using t-tests. Results showed that pilots scored significantly higher than non-pilots on several scales: Depression, Hypochondriasis, Hysteria, Social I-E (all significant at $p < .05$) and Psychopathic Deviate ($p < .01$). However, the authors used t-tests to compare scores across the two groups on 13 separate scales. Thus if a Bonferroni correction was used to counteract the increased probability of committing a Type I error that comes from making this many comparisons (.05/10 comparisons = .005 [this alpha level does not include the Lie, F and K-correction MMPI scales]), the pilots would have only scored significantly higher on the Psychopathic Deviate scale.

Geldard, F. A., & Harris, C. W. (1946). Selection and classification of aircrew by the Japanese. *American Psychologist, 1*, 205-217.

Gemelli, A. (1929). Osservazioni generali e ricerche sperimentali sulla selezione dei piloti di aviazione. *Rivista di Psicologia, 25*, 180-194.

Gemelli, A. (1929). Ricerche sulla selezione dei piloti di aviazione. *Atti VII. Convegno di Psicol. Sper. e Psicotecn.*, 158-159.

Gemelli, A. (1933). Observations sur la selection des pilots aviateurs. *Le Travail Humain, 1*, 1-23.

Sorts assessment instruments as either job representational or job analagous and as either empirical or analytical. Describes several tests and suggests the use of emotional behavior.

Gerathewohl, S. J. (1954). *Die Psychologie des Menschen im Flugzeug*. München,: J. A. Barth.

Gibb, G. D. (1987). *Development of a computer-based naval aviation selection test battery*. Paper presented at the 27th Annual Military Testing Association Conference, Ottawa, ON, Canada.

Since World War II, there has been a continuing effort to improve the tests used to select aircrew (10). Aptitude tests and biographical inventories have been updated periodically, and new tests have occasionally been added. Despite approximately 40 years of effort, the pilot composite of the United States Naval Aviation Officer Selection Battery has an uncorrected

predictive validity correlation of approximately +.15 to +.25 with a pass/fail criterion for undergraduate pilot training. The Air Force Officer Qualifying Test has predictive validities that are typically in the same range (7). Because of the escalating costs of training aircrew, it has become increasingly important to improve the predictive validity of aircrew selection batteries. At present, the general consensus of the selection community is that the existing paper-and-pencil tests fail to test adequately four major areas of individual differences that could increase the predictive validity of aircrew selection batteries: psychomotor skills, information processing abilities, higher-order cognitive processes, and personality (2,5,7,9,10). The lack of psychomotor tests in the existing aircrew batteries is an historical anomaly; during World War II, both the Navy and the Army Air Corps aircrew selection batteries included extensive apparatus tests to evaluate psychomotor skills. In the early 1950s, apparatus tests were eliminated from both batteries because of problems with calibration and reliability. Subsequently, researchers assumed that any psychomotor tests would present similar problems. More recently, advances in microprocessors have eliminated calibration and reliability problems and have made large-scale testing feasible. Recent Air Force studies (7,9) of two computer-generated psychomotor tests demonstrated that scores from the two psychomotor tests made unique contributions to prediction beyond that contributed by the existing paper-and-pencil aircrew tests. Because of these encouraging results, these two tests have been added to the Air Force aircrew selection battery.

Gibb, G. D. (1990). Initial validation of a computer-based secondary selection system for student naval aviators. *Military Psychology, 2*(4), 205-219.

Gibb, G. D., & Damos, D. L. (1986). Development of a computer-based naval aviation selection test battery. Naval Air Station, Pensacola, FL: Naval Aeromedical Research Laboratory.

Gibb, G. D., & Dolgin, D. L. (1988). *Validation of a computer-based aviation secondary selection system for student naval aviators*. Paper presented at the 32nd Annual Meeting of the Human Factors Society.

This report describes the validation of an automated aircrew selection test battery that measures cognitive processes, psychomotor skills, and time-sharing abilities. Results indicate that performance-based test measures can be used to predict flight training performance.

Gibb, G. D., & Dolgin, D. L. (1989). Predicting Military Flight Training Success by a Compensatory Tracking Task. *Military Psychology, 1*(4), 235-240.

Gibson, J. J. (Ed.). (1947). *Motion picture testing and research. Report No. 7*. Washington, DC: U.S. Government Printing Office.

Gibson, T. M., and Harrison, M.H. (2005). Aviation Medicine in the United Kingdom: Early Years, 1911-1918. *Aviation, Space, and Environmental Medicine, 76*, 599-600.

This is the first of three brief papers that summarize the history of aviation medicine in the Royal Air Force. Just as the generals and politicians were slow to appreciate the potential of the airplane, so was the medical establishment slow in understanding that the flight environment involved medical and physiological challenges. This note outlines the development of research to support British military aviators up to the formation of the Royal Air Force in 1918.

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Glomb, T. M., & Earles, J. E. (1997). Air Force Officer Qualifying Test (AFOQT): Forms Q development, preliminary equating and operational equating. Brooks Air Force Base, TX: Armstrong Laboratory.

Gnan, M., Flynn, C. F., & King, R. E. (1995). Psychological Pilot Selection in the U.S. Air Force, the Luftwaffe, and the German Aerospace Research Establishment. Brooks AFB, TX: Armstrong Laboratory.

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Goebel, R. A., Baum, D. R., & Hagin, W. V. (1971). Using a ground trainer in a job sample approach to predicting pilot performance. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

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Goeters, K.-M. (2004). *Aviation psychology : practice and research*. Aldershot, Hampshire, England ; Burlington, Vt.: Ashgate Pub.

Goeters, K.-M., & Lorenz, B. (2002). On the implementation of item-generation principles of the design of aptitude testing in aviation. In S. H. Irvine & P. C. Kyllonen (Eds.), *Item Generation for Test Development* (pp. 339-360). Mawah, NJ: Lawrence Erlbaum Associates.

Goodenough, F. L. (1942). The selection of candidates for the Officer Candidate School at the Women's Army Auxiliary Corps training center. *Psychological Bulletin, 39*, 634-637.

Gopher, D. (1982). A selective attention test as a predictor of success in flight training. *Human Factors, 24*(2), 173-183.

Incorporation of a dichotic listening task of selective attention in the pilot selection test battery of the Israeli Air Force was studied using a group of 2000 flight cadets. In this test, subjects are presented with 48 auditory messages. Each message is composed of strings of words and digit names. Different strings are simultaneously presented to the two ears. Subjects are required to detect digit names in the relevant channel and to reconsider channel relevance upon indication. Three types of selective listening errors are recorded: omissions, intrusions, and switching errors. Flight cadets who had completed a two-year training program had significantly lower error scores on all attention measures. In addition, these measures had low correlations with all other tests of the pilot selection battery. Thus, attention capabilities appear to be an independent dimension that enhances the predictive validity of the present test battery.

Gopher, D., & Kahneman, D. (1971). Individual differences in attention and the prediction of flight criteria. *Perceptual and Motor Skills, 33*, 1335-1342.

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Gordon, H. (1991). Selection of ab initio pilot candidates: The SAS system. In E. Farmer (Ed.), *Human Resource Management in Aviation* (Vol. 1, pp. 19-27). Aldershot, UK: Avebury Technical.

Gordon, H. W., & Leighty, R. (1988). Importance of specialized cognitive function in the selection of military pilots. *Journal of Applied Psychology, 73*(1), 38-45.

Gordon, T. (1947). The Airline Pilot: A Survey of the Critical Requirements of His Job and of Pilot Evaluation and Selection Procedures. In Civil Aeronautics Administration Division of Research Research Report (Ed.). Washington, D.C.: Civil Aeronautics Administration Division of Research,.

It is the purpose of this paper to report certain aspects of a study conducted by the Aviation Branch of the American Institute for Research under the auspices of the National Research Council Committee on Aviation Psychology. Funds for the project were furnished by

the Civil Aeronautics Administration. This study, completed in November, 1947, was undertaken (1) to study current methods of selecting and evaluating the airline pilot and (2) to determine the critical requirements of his job. It was intended that the data obtained in this investigation be used as a basis upon which to develop improved procedures for selecting, training, and certifying airline pilots. At present the American Institute for Research is utilizing the data as a basis for devising a radically new type of flight examination for pilots seeking the Airline Transport Rating certificate. This latter project is under the same sponsorship as the study to be described in this paper. In the first phase of the study the general procedure followed was to survey the available sources of information pertaining to present methods of selecting and evaluating airline pilots. In the second phase of the project the procedure was to survey sources of information about the critical requirements of the airline pilot's job, an attempt being made to answer the question: "What behavior and characteristics are required for handling the job safely and effectively?"

Gordon, T. (1949). The airline pilot's job. *Journal of Applied Psychology, 33*, 122-131.

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Gould, R. B. (1978). Air Force Officer Qualifying Test: Form M: Development and standardization: AFOSR.

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Gowron, V. J., Anno, G., Fleishman, E. A., Jones, E. D., Lovesey, E. J., McGlynn, L. E., . . . Smith, B. L. (1991). *Human Factors Taxonomy*. Paper presented at the 35th Annual Meeting of the Human Factors Society.

This paper: 1) describes the need for a human-factors taxonomy; 2) identifies existing taxonomies from the scientific, training, test and evaluation, and mission modeling disciplines; 3) lists the rules used in combining these taxonomies into a single, coherent taxonomy; 4) presents the taxonomy at its top levels; and 5) provides a source for obtaining a copy of the AIAA Human-Factors Taxonomy standard.

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Grahame-White, C., & Harper, H. (1911). *The aeroplane: Past, present and future*. Philadelphia: J.B. Lippincott Co.

Grant, D. N. W. (1941). Problems in aviation medicine affecting military aviation. *Journal of Aviation Medicine, 12*, 274-279.

Graves, A. K. (1914). *The Secrets of the German War Office*. New York: McBride, Nast and Co.

Gray, W. R. (2010). *USAF Test Pilot Selection for the Next Generation*. Paper presented at the American Institute of Aeronautics and Astronautics U.S. Air Force T&E Days, Nashville, TN.

The USAF Test Pilot School serves as both an initial educational experience for future Air Force Material Command leaders and as a process through which these leaders are initially chosen. Although the educational element of the TPS has received much attention and effort over the last five years, including the accreditation of the school as a master's degree-granting institution, the selection process has seen little change over the last quarter century. Unfortunately, budgetary and manning considerations have tended to reduce rigor in the selection process. Recent experience at TPS and at other academic institutions has made it abundantly apparent that the quality of a student population has as much to do with the selection process as it has to do with the curriculum. Recognizing this, the TPS leadership embarked on a two-year effort to improve the rigor and comprehensiveness of the USAF test pilot selection process, resulting in the Comprehensive Candidate Evaluation Program. The CCEP goes far beyond the traditional records-only selection by incorporating a multi-aircraft flight evaluation and a broadly-scoped face-to-face interview for all pilot candidates. The first CCEP selection process was completed in late 2009 and showed great potential to improve the quality of the USAF TPS graduate and, in the long run, AFMC and national aircraft test and evaluation of leadership.

Graybiel, A., & West, H. (1945). The relationship between physical fitness and success in training of U.S. Naval flight students. *Journal of Aviation Medicine, 19*, 243-249.

Grayson, J. K., & Lyons, T. J. (1996). Cancer incidence in United States Air Force aircrew, 1975-89. *Aviation, Space, and Environmental Medicine, 67*(2), 101-104.

We compared the cancer incidence of male United States Air Force (USAF) aircrew (342 cancers, 532,980.97 man-years) with non-flying Air Force officers (827 cancers, 1,084,370.08 man-years) between 1975-89. METHODS: Incident cancer cases for both aviators and non-flying officers were obtained from USAF hospitalization records. Age-adjusted standardized incidence ratios (SIR's) were calculated for aircrew using data from the National Cancer Institute's Surveillance Epidemiology and End Results (SEER) program. Aviator age-adjusted cancer rate ratios were also obtained using non-flying officers as an internal comparison group. RESULTS: We observed statistically significant excesses of aircrew cancers for all sites, testis, and urinary bladder. All other aviator cancer classifications were not significantly different from the comparison cohort; most notably, cancers of the colon and rectum, skin (both malignant melanoma and non-epithelial), brain and nervous system, Hodgkin's Disease and leukemias. CONCLUSION: Previous studies of commercial pilots that demonstrated excesses of these cancers may have been biased by the use of external comparison groups. We used an internal comparison population to reduce selection bias, information bias and confounding. From these data we detected notable excess aircrew cancer risk for cancers of the testis, urinary bladder, and

all sites combined.

Greenston, P. M. (2002). Proposed New Army Aptitude Area Composites: A Summary of Research Results. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Greenston, P. M., Mower, D., Walker, S. W., Lightfoot, M. A., Diaz, T. E., McWhite, P. B., & Rudnik, R. A. (2001). Development of a Personal Computer-Based Enlisted Personnel Allocation System (PC-EPAS). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

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Gregorich, S. E., Helmreich, R. L., Wilhelm, J. A., & Chidester, T. R. (1989). Personality based clusters as predictors of aviator attitudes and performance. Moffett Field, CA: NASA-Ames Research Center.

Gregory, R. P., Oates, T., & Merry, R. T. (1993). Electroencephalogram epileptiform abnormalities in candidates for aircrew training. *Electroencephalography and Clinical Neurophysiology, 86*, 75-77.

Grether, W. F., Melton, A. W., & Kossman, C. E. (1944). Development of the S.A.M. steadiness aiming test, Form B, for use in the selection and classification of aircrew personnel. Randolph Field, TX: 27th AAF Base Unit, AAF School of Aviation Medicine.

The S.A.M., Steadiness Aiming Test, Form B, proved to be a mechanically satisfactory measure of hand steadiness. The test had excellent reliability. Validity of the test, however, was very low for prediction of success in elementary pilot training, The addition of a verbal stress element to the S.A.M. Steadiness Aiming Test did not result in an increase in validity.

Grice, R. L. (2006). *Personality Profiles of Experienced U.S. Army Rotary-Wing Aviators Across Mission Platforms.* Ph.D. Dissertation, Liberty University, Lynchburg, VA.

Grice, R. L., & Katz, L. C. (2006). Personality profiles of experienced U.S. Army aviators across mission platforms. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

To address the selection-related question, "What does the personality profile of the Army aviator of today look like?" 75 experienced Army aviators attending advanced leadership training completed the Revised NEO Personality Inventory, with scores depicting the five personality factors of: neuroticism, extraversion, openness, agreeableness, and conscientiousness. To address the classification-related question, "Are there certain personality profiles that distinguish among attack, scout, cargo, and utility pilots?" factor scores and their subsumed facet scores were compared across respondents representing the four mission platforms. Overall sample profiles and score differences among platforms are presented.

Grice, R. L., & Katz, L. C. (2007). Personality profiles of U.S. Army initial entry rotary wing students versus career aviators. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The U.S. Army Research Institute for the Behavioral and Social Sciences Rotary Wing Aviation Research Unit (ARI RWARU) administered the Revised NEO Personality Inventory to 217 student Army aviators awaiting Initial Entry Rotary Wing training. Scores reflected the incoming aviators‘ standings on five personality factors: neuroticism, extraversion, openness, agreeableness, and conscientiousness. The male student factor and facet scores were then compared with a sample of male career Army aviators. Personality differences and similarities between the two samples are discussed as laying the foundation for longitudinal research.

Griffin, G. R. (1987). Development and evaluation of an automated series of single- and multiple-dichotic listening and psychomotor tasks. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Attrition in undergraduate naval aviation training represents a costly problem. An average of 25% of student naval aviators fails to complete training. This study reports an effort to develop automated single- and multiple-dichotic listening and psychomotor tasks, which have the potential to reduce aviator attrition through improved selection and may also be useful in initial pipeline classification. Statistical analysis of Study I, comparing a forward and backward series of automated dichotic listening (DLT) and psychomotor (PMT) tasks, indicated that a backward-direction orientation associated with the psychomotor tests resulted in increased difficulty for all PMT measures and two of three multitask DLT measures. The correlational estimates of test-retest reliability for the multitask DLT and PMT measures were adequate for both series of automated tasks but slightly higher (r - .80 DLT, r - .90 PMT) for the backward series. There were significant correlations between the DLT and PMT tasks, for each series of single- and multitask measures. The relation between such seemingly different tasks is difficult to understand since the DLT is an auditory cognitive processing task, and the PMT is an eye, hand, foot coordination task. However, the significant correlations were both smaller and fewer in number for the backward series of automated tests. Study II was a correlational evaluation between the new automated multitask measures and old nonautomated tasks with demonstrated validity for the prediction of primary flight performance. The correlations between corresponding tasks of the new automated and old nonautomated tasks averaged .60 for the DLT measures and .66 for the PMT tasks. The results of Study III indicated that certain automated DLT and PMT measures were significantly related to primary flight grades (PFG) in Navy flight training. For the backward series of tasks, all DLT and PMT measures were significantly correlated with PFG. However, only two DLT and two PMT measures of the forward series were significantly related to FFG. No significant correlations were found between the automated DLT and PMT tests and the pass/fail criterion. The absence of a suitable number of flight failure attritions was discussed as a possible reason for this result. A regression analysis for the backward series of test measures and primary flight training criteria indicated that a psychomotor stick and rudder measure and the FAR selection test were significantly related to PFG ($R = .53$, $F(2,85) = 16.56$, $p < .000\ 1$). There were no significant correlations between the automated DLT and PMT measures and prior flight hours. These results indicate that a series of automated DLT and PMT tasks are suitable replications of an older version of nonautomated tasks. The advantages of the automated tasks are that they require less administrative support and provide automatic scoring of performance. The backward series of automated tasks, which was correlated

more strongly with criterion performance, should be administered to a large sample of student naval aviators to determine if the tests can account for additional variance in the prediction of flight training performance beyond that of current selection tests.

Griffin, G. R. (1988). *Evaluation of an automated series of single and multiple-psychomotor dichotic listening tasks*. Paper presented at the 32nd Annual Meeting of the Human Factors Society.

A series of automated psychomotor and dichotic listening tasks, which require little administrative support and provide automatic scoring of performance, has been developed. The automated tasks account for additional variance in predicting Navy flight training performance beyond that of current selection tests.

Griffin, G. R. (1998). Predicting Naval Aviator Flight Training Performance Using Multiple Regression and an Artificial Neural Network. *International Journal of Aviation Psychology, 8*(2), 121-135.

Evaluates the prediction of naval aviator flight training performance in whiting Field, Florida. Use of multiple regression and an artificial neural network; Conduction of cognitive and perceptual psychomotor tests; Efficiency in predicting flight grade training performance.

Griffin, G. R., & Hopson, J. A. (1978). An Evaluation of the Omnibus personality Inventory in the Prediction of Attrition in Naval Aviation Training. Naval Air Station Pensacola, FL: Naval Aeromedical Research Laboratory.

The numerous Navy research efforts to identify motivational predictors of student naval aviator and/or student naval flight officer attrition have met with little success. In spite of the failures associated with the application of personality or motivational measures to naval aviation populations, there is little doubt that much of the attrition in naval aviation training is of a motivational origin. As a result, research personnel continue to seek motivational measures that may identify those individuals most likely to succeed in training. The present report describes an evaluation of the Omnibus Personality Inventory (OPI) as a predictor of student motivational attrition in naval aviator flying training. Initial validation results suggested that certain OPI scales were predictive of student naval aviator and student naval flight officer success in naval flying training programs. A cross-validation analysis was conducted to determine the stability of these findings. The analysis indicated that significant cross-validity relationships existed for current selection tests but not for OPI predictor measures. It must be concluded that the OPI is not sufficiently related to student aviator training performance to be of value in the prediction of aviator motivational attrition. These results support previous conclusions that future aviation selection research should be directed toward the identification of performance oriented, non-paper-and-pencil measures as motivational predictors.

Griffin, G. R., & Koonce, J. M. (1996). Review of Psychomotor Skills in Pilot Selection Research of the U. S. Military Services. *International Journal of Aviation Psychology, 6*(2), 125.

Focuses on the historical perspective of the use of psychomotor, perceptual-cognitive paper-and-pencil and tests for the selection of pilot trainees by the military services in the U.S. Combination of paper-and-pencil and automated psychomotor tests for initial selection; Use of automated cognitive and psychomotor tests; Predictors of pass-fail criteria. Focuses on the

historical perspective of the use of psychomotor, perceptual-cognitive paper-and-pencil and tests for the selection of pilot trainees by the military services in the U.S. Combination of paper-and-pencil and automated psychomotor tests for initial selection; Use of automated cognitive and psychomotor tests; Predictors of pass-fail criteria.

Griffin, G. R., & McBride, D. K. (1986). Multitask performance: Predicting success in naval aviation primary flight training. Naval Air Station Pensacola, FL: Naval Aeromedical Research Laboratory.

Attrition in undergraduate naval aviation training represents a costly problem. An average one in four student naval aviators fails to complete training. This study represents an attempt to reduce aviator attrition through improved selection. A multitask experiment simulating certain motor control and communication requirements characteristic of flight was conducted to determine relative strengths of several performance measures as predictors of primary flight training success.

Griffin, G. R., Morrison, T. R., Amerson, T. L., & Hamilton, P. V. (1987). Predicting air combat maneuvering (ACM) performance: Fleet fighter readiness program grades as performance criteria. Naval Air Station Pensacola, FL: Naval Aeromedical Research Laboratory.

A difficult aspect of predicting fleet pilot performance is acquiring meaningful and reliable, inflight criteria. Without such criteria , performance assessment is both theoretically and realistically impossible. This study was an attempt to predict Air Combat Maneuvering (ACM) performance using performance - based laboratory tests and to evaluate the VF-43 adversary squadron ' s grading of inflight ACM performance in the Fleet Fighter ACM Readiness Program at Naval Air Station Oceana . The purpose of the latter effort was to select convenient and reliable criteria for ACM performance assessment and use in the validation of the laboratory tests. In an initial evaluation (Study I), F-4 pilots performed in Fleet Fighter ACM Readiness exercises and completed performance - based perceptual motor and multitask tests. Results indicated that dichotic listening test measures , obtained during multitask conditions, could be used to reliably predict ACM inflight criteria . Results of a larger sample of F-14 pilots (Study II) indicated that an overall ACM grade (OAG) assigned by VF - 43 adversary personnel can be predicted reliably by an objective kill difference composite score and three subjective measures : situational awareness, mutual support , and energy management. These four measures accounted for 78 % of the variance with the OAG. A correlational analysis suggests that the VF-43 grading process is reliable and consistent. Additional results were obtained on the relation between the Naval Aerospace Medical Research Laboratory vision tests and ACM criteria (Study III). Contrast sensitivity measures were significantly related to a mean time-to - first- kill measure. Visual acuity and accommodative flexibility measures were significantly related to the initial sighting (tally - ho) and visual identification (VID) of adversary aircraft on an instrumented range. Age and / or experience in ACM may be an important variable in relating vision tests to pilot performance. It is recommended that: (1) improved performance - based tests should be administered to a sample of Navy pilots performing in Fleet Fighter ACM Readiness Evaluations to replicate initial test results ; and (2) an overall ACM grade regression equation should be applied to a supplementary sample of pilots performing in Fleet Fighter ACM Readiness exercises to confirm the reliability and validity of the VF-43 adversary squadron' s grading process.

Griffin, G. R., & Mosko, J. D. (1977). Naval aviation attrition 1950-1976: Implications for the development of future research and evaluation. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Griffin, G. R., & Mosko, J. D. (1982). Preliminary Evaluation of Two Dichotic Listening Tasks as Predictors of Performance in Naval Aviation Undergraduate Pilot Training (pp. 22). Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Attrition in undergraduate naval aviation training represents a costly problem. An average of 25% of student naval aviators fails to complete training. This study reports an effort to develop automated single- and multiple-dichotic listening and psychomotor tasks, which have the potential to reduce aviator attrition through improved selection an may also be useful in initial pipeline classification. Statistical analysis of Study I, comparing a forward and backward series of automated dichotic listening (DLT) and psychomotor (PMT) tasks, indicated that a backward-direction orientation associated with the psychomotor tests resulted in increased difficulty for all PMT measures and two of three multitask DLT measures. The correlational estimates of test-retest reliability for the multitask DLT and PMT measures were adequate for both series of automated tasks but slightly higher (r - .80 DLT, r - .90 PMT) for the backward series. There were significant correlations between the DLT and PMT tasks, for each series of single- and multitask measures. The relation between such seemingly different tasks is difficult to understand since the DLT is an auditory cognitive processing task, and the PMT is an eye, hand, foot coordination task. However, the significant correlations were both smaller and fewer in number for the backward series of automated tests. Study II was a correlational evaluation between the new automated multitask measures and old nonautomated tasks with demonstrated validity for the prediction of primary flight performance. The correlations between corresponding tasks of the new automated and old nonautomated tasks averaged .60 for the DLT measures and .66 for the PMT tasks. The results of Study III indicated that certain automated DLT and PMT measures were significantly related to primary flight grades (PFG) in Navy flight training. For the backward series of tasks, all DLT and PMT measures were significantly correlated with PFG. However, only two DLT and two PMT measures of the forward series were significantly related to FFG. No significant correlations were found between the automated DLT and PMT tests and the pass/fail criterion. The absence of a suitable number of flight failure attritions was discussed as a possible reason for this result. A regression analysis for the backward series of test measures and primary flight training criteria indicated that a psychomotor stick and rudder measure and the FAR selection test were significantly related to PFG ($R = .53$, $F(2,85) - 16.56$, $p < .000\ 1$). There were no significant correlations between the automated DLT and PMT measures and prior flight hours. These results indicate that a series of automated DLT and PMT tasks are suitable replications of an older version of nonautomated tasks. The advantages of the automated tasks are that they require less administrative support and provide automatic scoring of performance. The backward series of automated tasks, which was correlated more strongly with criterion performance, should be administered to a large sample of student naval aviators to determine if the tests can account for additional variance in the prediction of flight training performance beyond that of current selection tests.

Griffin, G. R., & Mosko, J. D. (1985). The effects of vocal versus manual response modalities on multi-task performance. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Griffin, G. R., Mosko, J. D., Harris, S. D., Jones, T. N., North, R. A., & Owens, J. M. (1979). Psychometric Properties of Dichotic Listening and IMPACT Tests: Intercorrelations, Reliabilities, and Relationship to Naval Aviation Selection Tests. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Griffin, G. R., & Shull, R. N. (1990). Predicting F/A-18 fleet replacement squadron performance using an automated battery of performance based tests. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Several studies have suggested the possibility of predicting operational performance in fleet aviation environments. This report concerns the use of an automated performance-based test battery, involving cognitive and psychomotor functioning, to predict the operational performance of fighter pilots. Two groups of pilots who were completing fleet replacement squadron (FRS) training for the F/A-18 were tested on this battery. The older and more experienced pilot group got higher FRS grades than did the other group; test performance between these two groups was not significantly different. Those few significant correlations found between the test measures and the FRS grades were illogically patterned and of insufficient quantity or strength to demonstrate any reliable predictive ability. This could have been due to the homogeneous nature of each of these subject groups in terms of piloting skills and abilities. Keywords: Pilot selection; Pipeline assignment; Psychomotor ability; Cognition; Dichotic listening; Multitask performance; Fleet aviation performance; Jet fighters; Flight training. (jg)

Griffin, R. (1988). An Improved Automated Selection System for Navy Pilots. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Since 1947, the Navy has relied on the Aviation Qualification Test (AQT) of general ability and the Flight Aptitude Rating (FAR) -- a composite of mechanical comprehension, spatial aptitude, and biographical tests--to select naval aviators. While this selection system has served the Navy well, the failure rate of pilot selectees has remained consistently high (although certainly less than the attrition rate before using a selection test battery), averaging 20-25% over the last 20 years. The cost of these failures represents millions of Navy training dollars lost each year. As a result, researchers at the Naval Aerospace Medical Research Laboratory have attempted repeatedly to improve selection test batteries. While previous efforts have failed, new research results appear to have the potential to improve our selection of pilots and naval flight officers.

Groesbeck, B., Jr. (1948). Personnel selection procedures in military aviation. *Military Surgeon, 103*, 16-19.

Guilford, J. P. (1943). Army selects and classifies an aircrew. *Education, 63*, 528-533.

Guilford, J. P., Christensen, P. R., Kettner, N. W., Green, R. F., & Hertzka, A. F. (1954). A factor-analytic study of Navy reasoning tests with the Air Force Aircrew Classification Battery. *Educational and Psychological Measurement, 14*, 311-325.

Guilford, J. P., Fruchter, B., & Zimmerman, W. (1952). Factor analysis of the Army Air Forces Sheppard field battery of experimental aptitude tests. *Psychometrika, 17*, 45-68.

Guilford, J. P., & Lacey, J., I. (Eds.). (1947). *Printed classification tests. Report No. 5*. Washington, D.C.: U.S. Government Printing Office.

Guinn, N., Alley, W. E., & Farmer, C. B. (1971). Impact of an all-volunteer force on AFROTC officer procurement. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Guinn, N., Alley, W. E., & Truax, S. R. (1972). Important factors in motivating AFROTC officer personnel in a zero-draft environment. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Guinn, N., Vitola, B. M., & Leisey, S. A. (1976). Background and interest measures as predictors of success in undergraduate pilot training (pp. 1-17). Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

The purpose of this study was to develop empirical keys to predict a variety of training outcomes using the Strong Vocational Interest Blank (SVIB) and the Officer Biographical and Attitudinal Survey (OBAS). Subjects were 593 pilot candidates who entered pilot training through Officer Training School (OTS). (It is interesting to note that UPT trainees from OTS represented the largest percentage of eliminees.) The SVIB has 54 occupational keys and five supplemental keys. The OBAS is a 116-item inventory which contains a variety of background and attitudinal items. It also contains the importance-possibility scale, which measures the importance of certain career needs and how likely it is that those career needs can be met by the Air Force. The predictive utility of the Air Force Officer Qualifying Test (AFOQT) score was also examined. Four criteria were used: total elimination (UPT pass/fail), Flying Deficiency Elimination (FLY), Self-Initiated Elimination (SIE) and Motivational Deficiency Elimination (SIEMOA). Regression analyses were conducted to examine the prediction obtained using the keys and the number of pilots correctly classified as passing or failing UPT using several different prediction models. The OBAS keys demonstrated significant cross-validity only for UPT pass/fail ($R = .13$, $p < .05$) and the FLY ($R = .14$, $p < .05$) criteria. Seventeen of the SVIB occupational scales demonstrated significant zero-order validities with UPT pass/fail resulting in a multiple correlation of .45 (not cross-validated). Three different models combining a variety of these predictors were tested. Model 1 consisted of the 17 SVIB scales, the four OBAS keys and the AFOQT (cross-validity = .14, $p < .05$). Model 2 consisted of just the 17 SVIB scales and the AFOQT (cross-validity = . 11l ns). Finally, Model 3 consisted of the four OBAS keys and the AFOQT (cross-validity = .14, $p < .05$). With respect to classification of pass or fail, Model 1 was the most efficient, resulting in an overall correct classification of 7 1 percent. The authors conclude that non-cognitive data have practical value in the selection of pilot trainees.

Guttman, G., Baker, H., & Trimmel, M. (1984). *Ergopsychometry: Testing under load. A computer-assisted test battery for aircraft pilot selection*. Paper presented at the 26th Annual Military Testing Association Conference, Munchen, FRG.

Psychological diagnostics are often charged with predicting how well a person will

perform under LOAD in a precarious situation. It is all the more paradoxical that the data upon which such prognoses have traditionally been based are invariably won under neutral, if not to say sterile, conditions - a far cry from the actual situation under question. Sports and Traffic psychologists have undertaken to make amends for this shortcoming by simulating the real-life conditions in the laboratory. This strategy, however, has its price; for in so doing, the psychologist must make compromises in objectifying specific behavioral dimensions separately. As the laboratory simulation approximates the actual demands upon everyday performance for the behavior studied, the single, unique capability, dimensions become confounded, hopelessly intermingled. The effect is that prognoses regress to the range of chance.

Hall, E. M., & Tirre, W. C. (1998). *USAF Air Vehicle Operator Training Requirements Study*. Brooks Air Force Base, TX: Air Force Research Laboratory.

Hall, G. S. (1916). *Practical Relations Between Psychology and the War*. Paper presented at the 25th Anniversary of the American Psychological Association, New York.

Rash as it may seem to draw any lesson as yet from the present war, in which the great Nordic race which embraces the dominant elements in all the belligerent nations is committing suicide, the following points, which can be only hinted at in my twenty minutes, seem to me worthy of consideration here. Mr. Hafner, through whom most of us receive our foreign periodicals, writes, "About one thousand French and German scientific publications have suspended as a result of the war, and about half of those that remain have been issued less frequently or in reduced size." They have also suffered in quality because so many collaborators doing the best work have been sent to the front, and many of them wounded or killed. About all the research being now carried on is in the medical field and in hospitals. Since April last practically all continental publications have been kept out of this country. This affects not only our journal clubs but cuts us off from the stimulus of European thought, so that we are now the only great country in the world where research can go on as before.

Hall, J. N., & Nordhoff, C. B. (Eds.). (1920). *The Lafayette Flying Corps* (Vol. II). Boston: Houghton Mifflin Company.

Hamilton, R. A., & Riley, R. (2002). *Machiavellianism and its relation to leader perception: A key to pilot selection*. Paper presented at the AIAA's Aircraft Technology, Integration, and Operations (ATIO) 2002 Technical, Los Angeles, CA.

A major focus of research in crew resource management (CRM) has been the association between personality and effective small-group leadership. In addition, the airline industry attempts to assess personality and temperament by placing pilot candidates through a two or three stage interview process. In an ongoing effort at Auburn University to develop a comprehensive a Pilot Candidate Selection Model, the authors have studied the relationship between the professional pilot‘s approach toward people as resources to accomplish goals and perception of effective leader behavior. Christie and Geis‘ Mach V scale (as a construct of skill in small group leadership) and a modification of the Bernard Bass Leadership Questionnaire (as a construct of leader perception) were employed in the survey of 98 Air Force officers 31 of which were serving actively as rated pilots. Research indicates a significant relationship in success in leadership of small groups and the Mach V scores. Using the measurements of the modified Bass questionnaire and the Mach V inventory as predictor variables, the authors

derived a discriminant function identifying pilots with ninety percent accuracy. Results indicate the potential use of the Mach V and the Bass Leadership Questionnaire as supporting instruments in the screening of candidates for commercial pilot training. The authors recommend extending current research to Part 141 flight training centers to validate the potential of the Mach V and the Bass instruments in evaluating students applying for commercial pilot training.

Han, T.-H., Chien, P.-C., Chen, H.-C., Chao, S.-M., & Wu, J.-T. (2001). *Developing an Effective Measurement of Visual–Spatial Ability in Pilot Selection Battery from A View Point of Cognitive Approach*. Paper presented at the 11th International Symposium on Aviation Psychology, Columbus, OH.

The purpose of this study was to re-explore possible factors that influenced the subjects‘ visual-spatial information processing as they took mental rotation tests. Two types of mental rotation tests were designed to measure subjects‘ visual-spatial abilities. One type of mental rotation task required the subject to distinguish figure‘s rotation angle between <90 and > 90 degrees. All 177 subjects of four groups varying in flight experience (0 hr, 8-23 hrs, 82-85 hrs and instructor-pilots) were assessed with 80 stimuli. The results of the comparison among four groups indicated that the accuracy ratio was the most reliable factor in measuring individuals‘ visual-spatial ability. The increase of complexity level could be considered to improve this experiment. Another type of mental rotation task required the subject to distinguish between an object and its mirror image. Different complexity levels of stimuli were used. All 70 subjects of two groups (passed and failed 12-15 hour flying training program) were assessed with 240 stimuli. The componential analysis was used to analyze the information process of the mental operation. The results indicated that the task‘s internal validation was good and the estimation of the higher level of complexity stimuli was significant. The parameter pool of pilots selection module examined the parameters that estimated by the componential analysis. The results indicated that mental rotating tests, using higher level of complexity stimuli, could be considered as part of the test for pilot selection battery.

Hancock, P. A., Mouloua, M., Gilson, R. D., Szalma, J., & Oran-Gilad, T. (2007). Provocation: Is the UAV control ratio the right question? *Ergonomics in Design, 15*, 7, 30-31.

There are a variety of on-going attempts to generate unmanned aerial vehicle (UAV) technologies to exploit the advantages that these semiautomated and automated airborne platforms promise to render. (Although we refer specifically to UAVs here, our arguments apply, in principle, to all remote vehicles whatever their medium of operation. The principles themselves also extend to other forms of nontransport-based entities.) With regard to such operations, the collective community is searching for the ratio between operator(s) and vehicle(s) that will prove most efficient and effective.

Haney, C. W. (1973). *Does the USAF Officer Biographical Inventory portion of the AFOQT inadvertently measure authoritarian personality?* Paper presented at the 15th Annual Military Testing Association Conference, San Antonio, TX.

Hansen, D., & Wolf, G. (2000). Aircrew in the German Air Force. *Modeling, Simulation and Training,* 26-30.

Hansen, H. D. (1990). *Flight Psychological Selection System - FPS 80: A New Approach to the*

Selection of Aircrew Personnel. Paper presented at the 32nd Annual Military Testing Association Conference, Orange Beach, AL.

The Selection of Air Force and Navy flight personnel is a progressive process, commencing. before the enlistment of the candidates (Phases 1 and 2) and continuing after the normal military training (which lasts for approximately one year) into Phase 3. The first Phase is a general screening of such factors as Intelligence and Leadership qualities, carried out in the respective Officer or NCO Selection Centres. The second Phase is a preliminary flight-aptitude screening, using Computer-based psychological tests, grading candidates as broadly _Suitable' or _Unsuitable'. The third Phase is more precise, making a final decision as to candidate suitability and further predicting what particular activity each candidate would be best suited for (e.g. Jet, WSO, Prop, Helicopter or Navigator). It consists of 3 weeks Navigation/Academic instruction, 1 week FPS 80 Selection and for those who have survived thus far, 5 weeks Flying instruction on light prop aircraft, including 18 flying hours. FPS 80 is the abbreviation for the Flight Psychological Selection System of the Aviation Psychology Section, Aerospace Medical Institute of the German Air Force. As the need was identified to improve the effectivity and reliability of the Selection System, FPS 80 was conceptualised. It was then designed and a detailed Functional Specification was prepared, from which the required Hardware and Software was commissioned. FPS 80 was installed in July of 1987, from which time it was further tested and standardized. It was introduced as part of the selection process on the 1st April, 1990. In this paper, we will concern ourselves with a description and statistical evaluation of the FPS 80 Selection system.

Hanson, M. A., Hedge, J. W., Logan, K. K., Bruskiewicz, K. T., Borman, W. C., & Siem, F. M. (1996). *Development of a computerized pilot selection test*. Paper presented at the International Military Testing Association Meeting, San Antonio, TX.

For years pilot selection has focused primarily on the identification of individuals with superior flying skills and abilities. More recently, the aviation community has become increasingly aware that successful completion of a flight or mission requires not only flying skills, but the ability to work well in a crew situation. This paper describes the development, validation and computerization of a situational judgment test, called the Situational Test of Aircrew Response Styles (STARS), which targets the interpersonal skills necessary to function effectively in a crew situation. Recent research, especially in the crew resource management (CRM) area, highlights the importance of interpersonal skills and certain personality traits for effective pilot performance. This crew resource management research was motivated by analyses of the causes of aircraft accidents which showed that the majority of these accidents involved crew errors (Foushee, 1984). Further analysis indicated that aspects of the crews' interpersonal interactions such as breakdowns in coordination and communication most frequently played a causal role in these accidents (e.g., Cooper, White, & Lauber 1980). Helmreich (1987) hypothesized that pilot performance is determined by ability, personality, and attitudes, and suggested that since the first two variables are very difficult to change, crew resource management training should focus on changing attitudes. Thus, training can be viewed as a way to promote awareness of group dynamics, bring about attitude change, and improve interpersonal skills, but it does not change the underlying traits that have been shown to be related to crew resource management. However, selection based on personality traits and/or relevant interpersonal skills may enhance crew resource management performance, above and beyond what could be expected from crew resource management training alone.

Harding, F. D., & Richards, J. A. (1971). A descriptive analysis of the classification, assignment, and separation systems of the armed services. Alexandria, VA: Human Resources Research Organization.

This report describes research done by the Human Resources Research Organization Force on the first phase of project RELAY, The Impact of Military national Aspirations and Development of Skills. The overall purpose of the research is to increase the degree of benefits of an occupational nature achieved by military personnel, during and after active duty , through improvements in the interface and civilian occupational manpower systems. The research efforts are expected to contribute to this goal by providing information needed for better manage linkages and interchanges between the military and civilian manpower systems.

Hardison, C. M., Sims, C. S., & Wong, E. C. (2010). The Air Force Officer Qualifying Test: Validity, fairness, and bias. Santa Monica, CA: RAND Corp.

The Air Force Officer Qualifying Test (AFOQT) is an aptitude measure used to select officers, pilots, and combat system operators. This technical report reviews research that answers many common questions about the AFOQT, including whether the test is fair, whether it is biased against minorities or women, whether it is too expensive, whether it should be replaced, and whether it predicts the performance that is important to the Air Force. In addressing these questions, we do not produce original data analyses. Instead, we present a synthesis of the existing knowledge about the AFOQT and other selection tests and examine its implications for the future of the AFOQT.

Harrell, T. W. (1945). Aviation psychology in the Army Air Forces. *Psychological Bulletin, 42*, 386-389.

Harrell, T. W., & Churchill, R. D. (1941). The classification of military personnel. *Psychological Bulletin, 38*, 331-353.

Harris, C. S., Ambler, R. K., & Guedry, F. E. (1963). A brief vestibular disorientation test. Naval Air Station Pensacola, FL: Naval School of Aviation Medicine.

Harris, D. (1997). *Engineering psychology and cognitive ergonomics*. Aldershot, Hants, England ; Brookfield, Vt., USA: Ashgate.

Harris, S. D., Owens, J. M., & North, R. A. (1979). Human performance in time-shared verbal and tracking tasks. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Harsveld, M. (1991). The Defense Mechanism Test and success in flying training. In E. Farmer (Ed.), *Human Resource Management in Aviation* (pp. 51-65).

Hartke, D. D., & Short, L. O. (1988). Validity of the academic aptitude composite of the Air Force Officer Qualifying Test (AFOQT). Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

This paper addresses the use of the Schmidt-Hunter meta-analysis procedure to determine

the generalizability of the Air Farce Officer Qualifying Test (AFOOT) validities across Air Force specialties (AFSs). Meta-analyses were conducted on all available Academic Aptitude composite validities aggregated and disaggregated into major occupational subgroupings. The results suggest that although the validity of the Academic Aptitude composite of the AFOQT may vary across AFSs, the AFOQT is of general value in officer selection.

Hartman, B. (1950). *The development of techniques and procedures for the study of alertness in aviation personnel*. Columbus.

Hausman, H. J. (1948). Validation of the Aircrew Classification Battery against operational criterion of instrument flying success. Omaha, NE: Headquarters, Strategic Air Command.

Hawkins, H. L., & Ketchum, D. (1980). The case against secondary task analyses of mental workload. Arlington, VA: Office of Naval Research.

Hawkins, H. L., Rodriguez, E., & Reicher, G. M. (1979). Is time-sharing a general ability? Arlington, VA: Office of Naval Research.

Haygood, R. C., Leshowitz, B., Parkinson, S., & Eddowes, E. E. (1974). Visual and auditory information processing aspects of the acquisition of flying skills. Williams Air Force Base, AZ: Air Force Human Resources Laboratory.

Hayward, B. J., Lowe, A., & Australian Aviation Psychology Association. (2000). *Aviation resource management : proceedings of the Fourth Australian Aviation Psychology Symposium*. Aldershot England ; Burlington Vt. USA: Ashgate.

Hayward, B. J., Lowe, A. R., & Australian Aviation Psychology Association. (1996). *Applied aviation psychology : achievement, change, and challenge : proceedings of the Third Australian Aviation Psychology Symposium*. Aldershot ; Brookfield, VT: Avebury.

Hayward, C. B. (1912). *Aeronautical Practice: Part I*. Chicago: American School of Correspondence.

Hayward, C. B. (1912). *Aviation and Its Future*. Chicago: American School of Correspondence.

Hayward, C. B. (1912). *Building and Flying an Aeroplane: A Practical Handbook Covering the Design, Construction, and Operation of Aeroplanes and Gliders*. Chicago: American School of Correspondence.

Hayward, C. B. (1912). *Practical Aeronautics: An Understandable Presentation of Interesting and Essential Facts in Aeronautical Science*. Chicago: American School of Correspondence.

Hayward, C. B. (1919). *Practical Aviation: Understandable Presentation of Interesting and Essential Facts in Aeronautical Science* (Second ed.). Chicago: American Technical

Society.

Hedge, J. W., Borman, W. C., & Hanson, M. A. (1996). *Videotaped Crew Resource Management Scenarios for Selection and Training Applications*. Paper presented at the 38th Annual International Military Testing Association Conference, San Antonio, TX.

Crew resource management (CRM) researchers and practitioners typically take a training approach to improving crew performance. Since the late 1970s, CRM training programs have become an increasingly important part of the commercial aviation industry. Most of the major commercial airlines have either developed their own CRM training programs or adapted existing training programs to suit their own needs (see Prince, Chidester, Bowers, & Cannon-Bowers, 1992). While CRM has existed in "pockets" of the military for years, because of the multitude of commands and locations, a broad-based application has been slower to evolve. The Air Force has recently published an Air Force Instruction (AFI 36-2243) that, for the first time, establishes broad requirements for developing and managing CRM training programs, and requires CRM training for all Air Force aircrew members (Secretary of the Air Force, 1994). Research has shown that CRM training does change attitudes linked to airline incidents and accidents, including attitudes toward communication and coordination, attitudes toward command responsibility, and recognition of stress effects (e.g., Irwin, 1991). In addition, Hehnreich, Foushee, Benson, and Russini (1986) demonstrated a link between CRM attitudes and line flying performance. However, Prince et al. (1992) cite evidence which suggests that the personalities of trainees set limits on training effectiveness and attitude change. Thus, recent research in the area of CRM points to the importance of interpersonal skills and certain personality traits for effective pilot performance. Training can be viewed as a way to promote awareness of group dynamics, bring about attitude change, and improve interpersonal skills, but it does not change the underlying traits that have been shown to be related to CRM. Selection based on personality traits and/or relevant interpersonal skills could greatly enhance CRM performance, above and beyond CRM training alone.

Hedge, J. W., Bruskiewicz, K. T., Borman, W. C., Hanson, M. A., Logan, K. K., & Siem, F. M. (2000). Selecting Pilots With Crew Resource Management Skills. *International Journal of Aviation Psychology, 10*(4), 377-392.

Hedge, J. W., Hanson, M. A., Bruskiewics, K. T., & Logan, K. K. (1997). Predicting the crew resource management skills of Air Force pilots. Brooks Air Force Base, TX: Armstrong Laboratory.

Hedge, J. W., Hanson, M. A., Siem, F. M., Bruskiewicz, K. T., Borman, W. C., & Logan, K. K. (1995). *Development and validation of a crew resource management selection test for Air Force transport pilots*. Paper presented at the 8th International Symposium on Aviation Psychology, Columbus, OH.

Heimstra, N. W., Louis, N. B., & Young, A. R. (1962). Survey of operational activities of fixed wing aviators. Fort Rucker, AL: Human Resources Research Office.

Heimstra, N. W., Louis, N. B., & Young, A. R. (1962). Survey of operational flying activities of rotary wing aviators. Fort Rucker, AL: Human Resources Research Office.

Helme, W. H., Willemin, L. P., & Day, R. W. Psychological factors measured in the differential officer battery. Alexandria, VA: Behavioral and Systems Research Laboratory.

The report is one of a series of major publications marking the culmination of the OFFICER PREDICTION research program and the impact of the findings on BESRL's ongoing and newly formulated program on officer evaluation and career development. The first publication in the series derived important dimensions of officer leadership behavior. In the present study, the major psychological factors derived from officer responses to tests of the experimental differential officer battery (DOB) are identified and delineated; the experimental predictor scores resultant from a reduction of the large number of measures obtained are described.

Helmreich, R. L. (1986). *Pilot selection and performance evaluation: A new look at an old problem*. Paper presented at the Psychology in the Department of Defense Conference, USAF Academy, Colorado Springs, CO.

Helmreich, R. L. (2006). Caveat Aviator. *PsycCRITIQUES*.

This is a review of the book, Pilots, Personality, and Performance: Human Behavior and Stress in the Skies edited by Sheila R. Deitz and William E. Thoms (1991).

Helton, K. T., Nontasak, T., & Dolgin, D. L. (1987). Landing craft air cushion (LCAC) crew selection system manual. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Helton, K. T., & Street, D. R. (1992). The Five-Factor Personality Model and Naval Aviation Candidates (pp. 16). Pensacola, FL: Naval Aerospace Medical Research Laboratory.

As personality testing has improved, various models for constructing and interpreting aviation selection tests have been proposed. Of particular interest to our study is the use of the five-factor personality model to naval aviation selection test interpretation and development. The five personality factors are conscientiousness, agreeableness, openness, extraversion, and neuroticism. Therefore, we conducted a joint factor analysis on the Pilot Personality Questionnaire (PPO) and the Edwards Personal Preference Schedule (EPPS) taken by 158 Navy and Marine Corps student aviators. A principal component analysis (PCA) and a factor analysis (FA) with varimax rotations produced a robust five-factor solution. On the basis of content analysis, the FA factors obtained in our study coincided with the five classic dimensions of the five-factor personality model. Although investigations of personality in pilot selection have yielded mixed results, the finding of a five-factor solution in our study suggests that the five-factor personality model may be useful in personality testing in aviation selection decisions.

Hemingway, A. (1946). Selection of men for aeronautical training based on susceptibility to motion sickness. *Journal of Aviation Medicine, 17*, 153-163.

Hendrikson, I. J. M., & Elderson, A. (2001). The use of EEG in aircrew selection. *Aviation, Space, and Environmental Medicine, 72*(11), 1025-1033.

The value of the electroencephalograph (EEG) as a screening device in aviation medicine is questioned, because few subjects are disqualified on grounds of an EEG exam. At the Netherlands Aeromedical Institute, pilot applicants are rejected with a diagnosis of epilepsy or

with severe EEG abnormalities (including epileptiform patterns where epilepsy is highly suspected). Although several studies have shown a low incidence of epileptiform EEG abnormalities in candidate pilots, subjects with an epileptiform EEG have a substantially increased risk of sudden incapacitation during their flying careers. In this review, we calculate the probability that a candidate with epileptiform EEG, but no history of epileptic seizures, will develop seizures during his flying career. This probability is about 25%, more than 12 times higher than for subjects with normal EEG and no history of epileptic seizures (2%). Subjects with epileptiform EEGs not only have increased risk of future epileptic seizures, but additionally it is recognized that epileptiform EEG discharges may be associated with episodic functional impairment, which can be a danger when a subject is flying. Taking this into account, one should consider rejecting all candidates with epileptiform EEGs in the future. This is at the expense of a small group of subjects with false-positive EEGs, but we believe that concern for public safety must override other considerations in these rare cases. To improve the understanding of the usefulness of the EEG in pilot screening procedures, an international classification and coding system should be developed, so that data from different countries can be compared.

Henley, I. M. A. (2003). *Aviation Education and Training: Adult Learning Principles and Teaching Strategies*. Aldershot, Hampshire, England ; Burlington, VT: Ashgate.

Henmon, V. A. C. (1919). Air service tests of aptitude for flying. *Journal of Applied Psychology, III*(2), 103-109.

From the psychologist's point of view an outstanding feature of the war has been the demand for highly specialized abilities and aptitudes in addition to general military virtues. No where has this been more true than in the Air Service and no where have the problems of selecting individuals and assigning them to the work for which they are best fitted been more urgent. As late as April 1917, the Aviation Section of the Signal Corps had but 52 trained flyers The Air Service with upwards of 16,000 flyers is thus a new product. When war was declared the need for selecting thousands of men for training as pilots, observers and balloonists was met by the creation of Examining Boards and Physical Examining Units Rigorous physical and medical standards were adopted. While the mental, moral and professional requirements were equally exacting the standards were necessarily vague and general. We were instructed to select men of good education and high character, men who were in every way qualified and fitted to become officers of the U. S Army — a rather intangible set of specifications We were constantly enjoined to remember that the flying officer was not to be an " aerial chauffeur," but a " twentieth century cavalry officer mounted on Pegasus."

Henneman, R. H. (1946). Proficiency measures for fighter pilots at the operational level of training in the Army Air Forces. *American Psychologist, 1*, 293.

Henneman, R. H., Hausman, H. J., & Mitchell, P. H. (1947). Measurement of instrument flying proficiency: USAF Strategic Air Command Technical Pamphlet.

Henry, G. V. (1945). *Report on Inter-Allied Personnel Board, 1942-1945*. Inter-Allied Personnel Board. Washington, DC.

Herold, D. M., Davis, W., Fedor, D. B., & Parsons, C. K. (2002). Dispositional influences on transfer of learning in multistage training programs. *Personnel Psychology, 55*, 851-869.

The training effectiveness literature has paid little attention to the potentially dynamic interaction of individual differences with various phases of training in determining ultimate training success. This study investigates the role of individual differences in explaining the transfer of learning from 1 phase of training to another among pilot trainees in a multistage, aviation training program. Using 3 of the Big Five factors (Conscientiousness, Emotional Stability, Openness to Experience), the results showed these measures to contribute to the prediction of the number of hours it took for trainees to attain their private pilot's license. Significant interactions between some of these measures and success on an earlier, simulator phase of the training program were also found. The results are discussed in terms of both the role of individual differences in training research as well as the broader issue of transfer of learning between phases of training.

Hertli, P. (1982). The prediction of success in Army aviator training: A study of the Warrant Officer Candidate selection process. Fort Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences.

Hertsgaard, B. C. (1987). Birth order and the aviator. Maxwell Air Force Base, AL: Air Command and Staff College.

This report conducts limited exploratory research into the possible relationship between birth order and an above average aptitude for aviation training. It reviews some of the basic elements of the science of ethology, birth order traits and possible correlations to military aviators. The study concludes that actual research into the Navy and Air Force aviator populations should be conducted to establish what, if any, relationship exists. Improved selection criteria might be established.

Heselgrave, R., J., & Colvin, C. (1993). Selection of personnel for stressful occupations: The potential utility of psychophysiological measures as selection tools. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Hiatt, C. M., Mayberry, P. W., & Sims, W. H. (1997). Revalidation of the Aviation Selection Test Battery (ASTB). Alexandria, VA: Center for Naval Analyses.

Hilton, T. F., & Dolgin, D. L. (1991). Pilot selection in the military of the free world. In R. Gal & A. D. Mangelsdorff (Eds.), *Handbook of Military Psychology*. New York: John Wiley & Sons, Ltd.

This chapter documents the 80-year history of military pilot selection, both theory and methodology of a variety of different countries with a focus on the U.S. The authors reviewed a great deal of research on psychomotor skill/quickness and intelligence/aptitude, but only the portions of the chapter dealing with "personality/character" are reviewed. Self-selection and rigorous physical examinations played a major role in early military pilot selection, with only the most adventurous people volunteering. During the period prior to 1919, the measurement of emotional coolness under pressure was the focus of pilot screening. Later, ingenuity and courage were added in screening for air-to-air combat, and interviews and observation were the main approaches for tapping these characteristics. From 1919 to 1938, successful combat pilots were characterized as quiet, methodical men, not given to emotional excitement, who were able to inhibit instincts of self-preservation. At this time, Germany pioneered the use graphology to form

judgments of pilot characterological suitability (Wyatt & Teuber, 1944). The U.S. Army and Navy used interviews to judge psychiatric well-being, while Germany continued to emphasize observation of facial expressions and emotional reactions to stresses. From 1938 to 1945, the U.S. Army Air Force found that commercially available paper-and-pencil personality tests did not contribute to pilot selection, while European countries "emphasized screening pilots for the proper character" (at that time a term referring primarily to motivational potential, personal presence/domination and emotional calmness under stress). Interviews were common during this period and were usually guided by an applicant's answers to a paper-and-pencil biographical inventory. A great deal of research dealing with personality was conducted during the period from 1945 to 1970. Some of this research showed that personality inventories could accurately identify psychiatrically unsuitable applicants, but did not distinguish between successful and unsuccessful aviation cadets. Sells (1956) found that motivational factors were more predictive of long-term success as a pilot than of training performance. Prior to this, some countries were already screening based on nonclinical personality traits. Both Israel and Denmark screened for nonauthoritarian, egalitarian leadership style. Many European countries were also either using or evaluating the Defense Mechanism Test, which is a psychoanalytic projective instrument designed to measure stress tolerance.

Hjelmqvist, M., Sundqvist, G., Engman, L., & Sverin, B. (2000). *Pilot Selection in the Swedish Armed Forces*. Paper presented at the 42nd International Military Testing Association Conference, Edinburgh.

The testing procedure for applicants for operational service as fighter pilots is aimed at selecting candidates with; high theoretical capacity, high manual capacity, high mental capacity and high development potential as to competent fighter pilots. At the recruitment centre the applicants undergo a stepwise selection procedure. The first day consists of computerized group tests. If the results indicate potential the applicant is approved for a second day of individual tests. The second day ends with interviews by a psychologist and a pilot officer. At this stage the psychologist considers all input concerning the applicant and presents a synthesis to the daily selection board resulting in an eligibility rating. Those approved by the board are sent on to medical examination. Once a year a final selection board is held where psychologists, flight surgeons and pilot officers together decide on a final ranking order. There is a close connection between selection and training, and psychologists do follow-up studies on all stages of the pilot training as a way of getting continuous feedback from the system and vice versa, thus keeping updated with the progress of each individual and the demands that are placed upon them during training. The level of attrition during training is low, which is a result of successful selection where the individual is viewed from different professional angles in an overall perspective, and in combination with a training philosophy focused on supporting and not de-selecting.

Hobbs, N. (Ed.). (1947). *Psychological Research on flexible gunnery training. Report No. 11*. Washington, DC: U.S. Government Printing Office.

Hocking, B. (2003). *Training airline cadets from over 35 cultures: Some lessons learned*. Paper presented at the 12th International Symposium on Aviation Psychology, Columbus, OH.

Shows a syllabus hour versus module line and lines for cadets from different cultures, including those who eventually fail out. Shows that trend (slope) for those who fail is accelerating away from syllabus hour line. For those who make it, their lines lie on top of the

syllabus line or are above it but trend back toward it.

Hoeft, S., Damitz, M., & Beauducel, A. (2007). *Prediction differs from description: General versus specific intelligence testing for the selection of ab initio air traffic controllers*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

Meta-analyses and recent large-scale primary studies concerning the importance of intelligence indicate that for almost all jobs general mental ability (g) alone predicts performance well. However, there is a controversy concerning the question whether specific abilities (s) are needed to predict job or training performance. In the present study performance test data of 5223 applicants from the DLR program for selection of ab initio air traffic controllers at DFS Deutsche Flugsicherung GmbH were analyzed. Results of different approaches based on exploratory factor analysis and structural equation modeling to estimate g- and s-intelligence components were compared. In addition to this, the criterion-related validities of different g- and s-measures were tested using training performance criteria from 282 DFS trainees. It is argued that the preference for an intelligence model depends in part on the utilized theoretical approach and the objectives of the diagnostician (description vs. prediction).

Hoeft, S., Schumann-Sen, M., & Maschke, P. (2005). Peer evaluations in an assessment center for personnel selection: Do they contain information indicative for ratees or raters? *Zeitschrift fur Personalpsychologie, 4*(4), 159-169.

Hoermann, H.-J., Radke, B., & Hoeft, S. (2007). *Measurement of social competence in pilot selection*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

To ensure that pilots possess the necessary level of competence for effective teamwork during line operation, some airlines have introduced special test methods into their selection procedures that allow measuring different sub-components of Social Competence before a pilot applicant is being employed. Costs and benefits of these measures vary to some degree. For a German airline, we have conducted a validation study (N=292 ab-initio pilots) with several of these measures, including the Interpersonal Competence Questionnaire (Buhrmester, Furman, Wittenberg & Reis, 1988), the Social Skills Inventory (Riggio, 1989), the Temperament Structure Scales (Maschke, 1987), and Assessment Center methods (Hoeft & Pecena, 2004). Different sub-facets of Social Competence are described, which exhibit sufficient reliability and generality to be considered as predictors for pilot selection. The findings of this study reveal significant correlations between some personality scales and aspects of Social Competence. However, correlations with concrete behavior ratings in simulated social situations are low. On the other side, Assessment Center ratings based on behavior observations correlate substantially with the overall success of a candidate throughout the selection procedure. Questionnaire data contribute little extra variance to this equation. Results are discussed with reference to aspects of social desirability as well as costs and benefits of the different approaches to measure Social Competence in pilot selection.

Hoff, E. C., & Fulton, J. F. (1942). *A bibliography of Aviation Medicine*. Springfield, IL: Charles C. Thomas.

Hoffman, J. R., Kahana, A., Chapnik, L., Shamiss, A., & Davidson, B. (1999). The relationship of physical fitness on pilot candidate selection in the Israel Air Force. *Aviation, Space, and Environmental Medicine, 70*(2), 131-134.

The purpose of this study was to examine whether physical fitness is an important component in the selection process of pilot candidates to the Israel Air Force (IAF) flight school. METHODS: There were 223 male pilot candidates who volunteered to participate in the study. All subjects were tested 1 - 12 wk prior to a week-long "bootcamp" for aerobic power (Astrand bicycle test), anaerobic power (vertical jump test), and percent body fat. In addition, an activity profile was established based on an activity history questionnaire. All fitness measures were correlated to a performance score based on the IAF selection criteria measure for each candidate. RESULTS: Candidates who were accepted to flight school had a higher aerobic capacity, anaerobic power output relative to body weight and a lower percent body fat than candidates who were not successful. Significant correlations were seen between the performance score and aerobic power ($r = 0.31$), anaerobic power ($r = 0.17$) and anaerobic power relative to body weight ($r = 0.21$). Linear regression analysis showed that aerobic power explained 9% of the variance in the performance score, while anaerobic power explained an additional 3%. The results of this study suggest that physical fitness has a positive influence on the success of pilot candidates in gaining admittance to the IAF flight school.

Hogan, R., Hogan, J., & Roberts, B. W. (1996). Personality measurement and employment decisions. *American Psychologist*, 469-477.

The invisible college of psychologists who do research with measures of normal personality now largely agrees about the structure of personality; this group also agrees that competently developed personality measures are valid predictors of real world performance. Outside that college, however, there is still considerable skepticism regarding the meaning and validity of these measures. This article attempts to summarize the data needed to answer the most frequent questions about the use of personality measures in applied contexts. Our major conclusions are that (a) well-constructed measures of normal personality are valid predictors of performance in virtually all occupations, (b) they do not result in adverse impact for job applicants from minority groups, and (c) using well-developed personality measures for preemployment screening is a way to promote social justice and increase organizational productivity.

Hollander, E. P. (1952). An investigation of the relationship between academic performance in pre- flight and ultimate success or failure in basic flight training. Pensacola , FL: Naval School of Aviation Medicine.

Hollander, E. P. (1954). Peer nominations on leadership as a predictor of pass-fail criterion in Naval air training. *Journal of Applied Psychology, 38*, 150-153.

Hollander, E. P., & Sauaser, E. R. (1953). A further consideration of peer nominations on leadership in the Naval air training program. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Holtzman, W. H., & Sells, S. B. (1954). Prediction of flying success by clinical analysis of test protocol. *Journal of Abnormal and Social Psychology, 49*, 485-490.

This study examined the ability of expert clinical psychologists to predict advanced flight training success using an experimental battery of psychological tests. The tests were similar to those used by clinical psychologists, but had been adapted for group administration. The researchers used an extreme groups design. Fifty successful (e.g., passed flight training, pilot stanine of six or greater) and 50 unsuccessful (e.g., did not pass training, pilot stanine less than six) subjects were randomly selected from a much larger pool of 1504 test subjects. Subjects completed the Background Information Form (a biographical history inventory), the Ink-Blot test (group adaptation of the Rorschach), Feeling and Doing (a psychosomatic inventory), What Is He Saying (a sentence completion test), the L-D test (a group version of the Szondi test) and a group administered version of the Draw-A-Person test. Nineteen psychologists were given profiles of all subjects containing information from all of these tests. They were asked to judge whether a subject would pass or fail flight training. They made these judgments on a global level using all available information, and also make ratings of how confident they were in their judgments. A subset of these psychologists also made pass/fail judgments after examining each of the tests one at a time. Results showed that none of the psychologists were able to predict the pass/fail criterion at an accuracy level much better than chance using the global approach. Even when the researchers only examined those judgments that the psychologists were most confident in, only two were able to predict at a level better than chance. The results were very similar for the subset of psychologists who made pass/fail predictions after examining each test individually.

Hopkins, G. E. (2001, February). A short history of pilot shortages. *Air Line Pilot,* 18-54.

Hopkins, P. (1944). Observations on army and air-force selection and classification procedures in Tokio, Budapest, and Berlin. *Journal of Psychology: Interdisciplinary and Applied, 17*, 31-37.

Reviews aviator selection assessment in several countries. In 1935, the psychological laboratory at The Imperial University of Japan in Tokyo carried out work in aviator selection of aviators, including measurement of reactions to positional change. In Budapest, tests were developed to measure intelligence, observation and reporting ability, various psychophysical attributes, and others to select officers. German testing emphasized assessments of handwriting, speech, and vocational tests.

Hopson, J. A., Griffin, G. R., Lane, N. E., & Ambler, R. K. (1978). Development and evaluation of a naval flight officer scoring key for the naval aviation biographical inventory. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Hormann, H.-J., and Maschke, P. (1996). On the relation between personality and job performance of airline pilots. *International Journal of Aviation Psychology, 6*(2), 171-178.

Hormann, H.-J. (1998). Selection of civil aviation pilots. In K.-M. Goeters (Ed.), *Aviation Psychology: A Science and a Profession*. Aldershot: Ashgate Publishing.

Hormann, H.-J., & Luo, X. L. (1991). *Development and validation of selection methods for Chinese student pilots*. Paper presented at the 10th International Symposium on Aviation

Psychology, Columbus, OH.

Hormann, H.-J., Manzey, D., Maschke, P., & Pecena, Y. (1997). *Behavior-oriented assessment of interpersonal skills in pilot selection concepts, methods, and empirical findings*. Paper presented at the 9th International Symposium on Aviation Psychology, The Ohio State University, Columbus, OH.

Hormann, H.-J., & Maschke, P. (1993). *Personality scales as predictors for job success of airline pilots*. Paper presented at the 6th International Symposium on Aviation Psychology, Columbus, OH.

Horst, R. L., & Kay, G. G. (1991). *CogScreen: Personal computer-based tests of cognitive function for FAA medical certification*. Paper presented at the 6th International Symposium on Aviation Psychology, Columbus, OH.

Hotton, R. (2001). Growing with the flow. *Civil Aviation Training,* 26-29.

Houston, J. S., & Bruskiewics, K. T. (2006). Development and preliminary validation of a selection instrument for U.S. Army flight training (SIFT): Volume 2. Minneapolis, MN: Personnel Decisions Research Institutes, Inc.

Houston, J. S., & Bruskiewicz, K. T. (2006). Development and preliminary validation of a selection instrument for U.S. Army flight training (SIFT): Volume 1. Minneapolis, MN: Personnel Decisions Research Institutes, Inc.

Chapter 1 summarizes efforts conducted in relation to the first task, reviewing the existing Army Aviation accession process and relevant literature. The overall goal of this was to collect information that could be used to "produce a rational decision on a specific selection strategy and produce a rational decision on a specific testing strategy (from the Statement of Work for this contract, p. 3)." Chapter 2 details the job analysis undertaken to define the characteristics required for successful performance both in helicopter training and on the job. Chapter 3 describes the development and pilot testing of the predictors, or prototype instruments, and Chapter 4 describes the development of criterion measures to be used in the validation effort. Chapter 5 reports on the preliminary validation data collection and describes the results of both the predictor and the criterion data analyses. The final chapter, Chapter 6, presents the results of the validation analyses.

Houston, R. C. (1988). Pilot Personnel Selection. In S. G. Cole & R. G. Demarae (Eds.), *Application of interactionist psychology: Essays in honor of Saul B. Sells* (pp. 291-316). Hillsdale, NJ: Laurence Erlbaum.

Howse, W. (2007). *Trends in Army Aviation Training Applicants*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

Howse, W. R. (1990). *Aircrew selection and classification status*. Paper presented at the Department of Defense Human Factors Engineering Technical Group 29th Meeting.

Howse, W. R. (1993). *Aviation screening and performance prediction: Issues for discussion*. Paper presented at the Department of Defense Human Factors Engineering Technical Group 31st Meeting.

Howse, W. R. (1993). *Aviator selection and classification cooperative research efforts*. Paper presented at the Department of Defense Human Factors Technical Group 31st Meeting.

Howse, W. R. (1993). *U.S. Army aviator selection and classification research and development program update*. Paper presented at the Department of Defense Human Factors Engineering Technical Group 30th Meeting, Dayton, OH.

Howse, W. R. (1994). *Aircrew selection and classification research and development*. Paper presented at the Euro-NATO Aircrew Selection Working Group 19th Meeting, Toronto, Canada.

Howse, W. R. (1994). *Flight Aptitude Selection Test normative data*. Ft Rucker, AL: ARI Rotary Wing Avition Research Unit.

Howse, W. R., & Katz, L. C. (2004). *Selection instrument for flight training*. Paper presented at the Department of Defense Human Factors Technical Advisory Group 52nd Meeting.

Howse, W. R., & Katz, L. C. (2004). *Selection Instrument for Flight Training: Project history and background*. Paper presented at the SIFT Project Scientific Review, Arlington, VA. Scientific Review retrieved from

Hoy. (1997). *Pilot selection procedures for ab-initio pilot training*. Paper presented at the Four Forces, Montreal.

AR 611-110 Selection and training of Army aviation officers. Change 3. (1966).

AR 611-110 Selection and training of Army aviation officers. Change 1. (1968).

AR 611-110 Selection and training of Army Aviation officers (1970).

AR 600-107 C2 Medical Restriction/Suspension from Flight Duty, Nonmedical Suspensions, Flying Evaluation Boards, and Flight Status Review System (1972).

AR 611-110 (1972).

AR 611-110 Selection and Training of Army Aviation Officers (1972).

AR 611-110 Selection and Training of Army Aviation Officers (1981).

AR 40-501 Standards of Medical Fitness (2003).

Hunt, G. F. J., Sumolang, H., & Budiono, B. (1995). *Transforming ab initio pilots into*

professional airline flight crew: The Indonesian Experience. Paper presented at the Eighth International Symposium on Aviation Psychology, Columbus, OH.

Hunter, D. R. (1977). *Pilot selection research in the Air Force*. Paper presented at the 19th Annual Military Testing Association Conference, San Antonio, TX.

As part of the mission of the Personnel Research Division of the Air Force Human Resources Laboratory, continuing studies have been conducted to investigate ways to improve the selection procedures for admission to Undergraduate Pilot Training (UPT). This research has included attempts to improve the existing paper-and-pencil selection measures, investigations into the use of new solid-state psychomotor apparatus tests. And evaluations of learning ability through the use of a light-plane simulator. This report will outline the research that has been performed by the Personnel Research Division in these areas and will indicate some of the tasks that remain to be addressed.

Hunter, D. R. (1982). A comparison of live and simulated adaptive tests. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Hunter, D. R. (1987). *Automated aircrew aptitude assessment: Historical perspective*. Paper presented at the 27th Annual Military Testing Association Conference, Ottawa, ON, Canada. presentation retrieved from

A recent review of the English-language literature from 1910 to the present identified over 200 studies dealing with aircrew selection (Hunter, in press). This considerable volume of research reflects the continuing concern of the military services with aircrew selection and classification. Many instruments have been evaluated over the years, with varying degrees of success.

Hunter, D. R. (1989). Aviator selection. In M. F. Wiskoff & G. M. Rampton (Eds.), *Military Personnel Measurement: Testing, Assignment, Evaluation* (pp. 129-167). New York: Praeger Publishers.

Hunter, D. R. (1993). Meta-analysis of aviator selection measures. Washington, DC: Federal Aviation Administration, Office of Aviation Medicine.

Hunter, D. (2002). Risk Perception and Risk Tolerance in Aircraft Pilots. Washington, DC: Federal Aviation Authority.

Hunter, D. R. (2005). Measurement of hazardous attitudes among pilots. *International Journal of Aviation Psychology, a5*, 23-43.

Hunter, D. R. (2006). Risk perception among general aviation pilots. *International Journal of Aviation Psychology, 16*(2), 135-144.

Two measures of pilot risk perception are described. One measure assessed pilots‘ perception of the level of risk experienced by other, fictional, pilots, and the second measure assessed the pilots‘ perceptions of the level of risk they would experience if they were personally involved in a set of scenarios. Analyses are reported for factor scores derived from the 2 measures. Analysis of variance demonstrated significant differences in the risk ratings for the 4

pilot certificate groups with the more advanced certificate holders (i.e., commercial and airline transport) reporting lower levels of perceived risk. Construct validity was assessed using only private pilots (N = 369). Correlations between the factor scores and measures related to the constructs generally supported the construct validity of the risk perception measures. Inaccurate risk perception, measured as the discrepancy between the perceived risks of flying and driving, was found to be a better indicator of involvement in hazardous aviation events than any of the factor scores. It is suggested that the risk perception measures be used by other investigators to assess the contributions of these constructs to accident involvement in comparison to the contribution of other constructs.

Hunter, D. R., & Burke, E. (1987). Computer-based selection testing in the Royal Air Force. *Behavior Research Methods, Instruments, & Computers, 19*(2), 243-245.

Hunter, D. R., & Burke, E. F. (1990). An annotated bibliography of the aircrew selection literature. Alexandria. VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Hunter, D. R., & Burke, E. F. (1992). Meta analysis of aircraft pilot selection measures. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Hunter, D. R., & Burke, E. F. (1994). Predicting aircraft pilot-training success: A meta analysis of published research. *International Journal of Aviation Psychology, 4*(4), 297-314.

Hunter, D. R., & Burke, E. F. (1995). *Handbook of Pilot Selection*. Aldershot, UK: Avebury Aviation.

Hunter, D. R., Maurelli, V. A., & Thompson, N. A. (1977). Validation of a psychomotor/perceptual test battery. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Hunter, D. R., & Thompson, N. A. (1978). Pilot selection system development. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Hussey, A. K. (2004). Air force flight screening: Evolutionary changes, 1917-2003. Randolph AFB, TX: Office of History and Research, Headquarters Air Education and Training Command.

Until World War II, the Army Air Corps counted on its stringent qualification requirements and low production goals to screen its pilot candidates. During World War II, the Army Air Forces needed men to fill its requirements for 100,000 aircrew positions, and thousands of candidates went through the training process. Qualification requirements relaxed initially and became more rigorous as the need for pilots changed during the course of the war, but no true flight screening program existed until the Korean War with the advent of the Revitalized Pilot Training Program in November 1952. Demand for more pilots and high attrition rates during the Korean War, which were prevalent during World War II as well, combined with tight defense budgets to force the Air Force to turn to some sort of flight screening to reduce attrition rates. For most of the next decade, Air Training Command (ATC)

continued to run a light plane screening program; but the introduction of the T-37 and the all-jet training program in 1958 encouraged Air Force officials to view light plane screening as counterproductive. It ended two years later. However, the war in Southeast Asia increased the demand for pilots again, and ATC reintroduced light plane screening, which continued in various forms until insurmountable problems with the T-3A prompted the end of the program in 1997. Inevitably, attrition rates rose, ensuring the return to a new program, Introductory Flight Training. By 2002, however, the hunt was on for a replacement program to provide a higher degree of standardization and uniformity. As the Air Force faces an era of stressed budgets, filling its ranks with those who will earn their wings is imperative. A flourishing flight screening program is as important today as any time in the Air Force‘s history. As Air Education and Training Command embarks on yet another revision, returning to the philosophy of flight screening before flight training, it is instructive to examine how the command got to where it is today. Ultimately, concern with the monetary and personnel costs associated with high attrition rates guarantees that the Air Force will continue to use some sort of flight screening to identify pilot candidates whose probability to earn their wings is high—the very people who form the core of the Air Force‘s combat capability.

Hutchins, C. W. (1964). The relationship between the rank of incoming officers and completion of flight training. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Hutchins, C. W., & Kennedy, R. S. (1965). The relationship between past history of motion sickness and attrition from flight training. Pensacola, FL: U.S. Naval School of Aviation Medicine.

The purpose of the study was to determine if student scores on the Pensacola Motion sickness Questionnaire (MSQ) would supplement current multiple prediction formula in predicting completion of flight training and/or voluntary withdrawal from this training. The MSQ score was found to be significantly related to both completion of flight fining and voluntary withdrawal from training. With respect to this latter criterion, the MSQ was the single most valid predictor available. When included in the multiple prediction formulae, the MSQ significantly increased the multiple validity for predicting both criteria.

Hutchinson, W. (1918). *The Doctor in War*. New York: Houghton Mifflin Company.

Imhoff, D. L., & Levine, J. M. (1980). Development of a perceptual-motor and cognitive performance task battery for pilot selection. Washington, DC: Advanced Research Resources Organization.

Imhoff, D. L., & Levine, J. M. (1981). Perceptual-motor and cognitive performance task battery for pilot selection. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

A review of the literature on pilot selection and training perceptual-motor processes, and cognitive processes was conducted . The objectives of this review were: (a) to identify perceptual-motor and cognitive tasks that demonstrated reliable individual differences in performance and (b) to identify perceptual -motor abilities and cognitive processes of demonstrated importance to successful piloting behavior . From this review, a set of tasks were identified that tapped the abilities and processes important to piloting and that showed evidence of producing reliable individual differences in performance. A conceptual framework makes

explicit the link between the tasks selected and the requirements for successful pilot performance. This resulted in a large number of tasks which were candidates for inclusion in a pilot selection task battery. Psychometric and pragmatic criteria were applied to the tasks in the candidate pool, resulting in the identification of 15 tasks for inclusion in the final task battery. These tasks span the perceptual-motor and cognitive domains with special emphasis on Attentional and decision-making performance . The paradigms for the selected tasks are specified in detail to allow for the development and implementation of the tasks on a computer system, and a number of implications for validation of the battery are provided. The tasks included in the final battery are Perceptual Speed, Complex Coordination, Compensatory Tracking, Kinesthetic Sensitivity, Route Walking, Selective Attention, Time Sharing, Encoding Speed, Mental Rotation, Item Recognition, immediate/delayed Memory, Decision Making Speed, Probability Estimation, Risk Taking, and Embedded Figures.

Ingram, D. L. (1968). *Recent research in the selection and training of aircrew pilots for the Canadian armed forces*. Paper presented at the 10th Military Testing Association Conference, Lackland Air Force Base, TX.

The Canadian Armed Forces aircrew production system is similar to that of other military forces, in that it involves interrelated programmes of recruitment, selection, classification, and training. The object of the system is to produce aircrew pilots and navigators who meet specific performance standards and, moreover, to produce these highly-skilled personnel in specified numbers at minimal unit cost. The importance of economic factors in such a production system are emphasized by the fact that, as an individual progresses through the system from the recruiting level to the operational training units, the total monetary investment in a trainee increases cumulatively and the loss of a single trainee becomes increasingly important as he nears graduation. At the present time, aircrew officers are probably the most costly product which the Canadian Armed Forces are required to manufacture within their own resources.

Intano, G. P., & Howse, W. R. (1990). *Validation of the Army aviator classification system.* Paper presented at the 32nd Annual Military Testing Association Conference, Orange Beach, AL.

Intano, G. P., & Howse, W. R. (1991). *Multi-Track Assignment Battery*. Paper presented at the Euro-NATO Aircrew Selection Working Group 15th Meeting, Munich, Germany.

Intano, G. P., & Howse, W. R. (1991). Predicting performance in Army aviator classification process. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The Army Research Institute Aviation Research and Development Activity (ARIARDA) successfully implemented the Multi-Track Test Battery and associated classification functions in 1988. The battery and functions have been used to assign more than 4,000 flight students to their combat skills aircraft. The subsequent program determined the applicability of the battery to prediction of student performance in flight training. Performance evaluation in primary training consists of four-flight phase grades and 12 academic-phase grades. In addition to these, primary overall average grade and primary overall flight grade were predicted using forward stepwise multiple-regression procedures. Stepwise multiple-discriminant analysis was used to investigate two additional measures--flight deficiency training setback and flight deficiency attrition. The

capability of the battery to predict primary training grades is demonstrated. Results of discriminant analysis of setbacks and attrition should be viewed with caution.

Intano, G. P., & Howse, W. R. (1992). *Predicting performance in Army aviation flight training*. Paper presented at the 36th Annual Meeting of the Human Factors Society, Atlanta, GA.

The Army Research Institute Aviation Research and Development Activity successfully implemented the Multi-Track Test Battery (MTTB) and associated classification functions in 1988. The battery and functions have been used to assign flight students to their combat skills aircraft. The present program determined the applicability of the battery to prediction of student performance in flight training. Performance evaluation in training consists of flight phase grades and academic phase grades. In addition to these grades, Overall Average Grade and Overall Flight Grade were also predicted using Forward Stepwise Multiple Regression procedures. Stepwise Multiple Discriminant Analysis was used to investigate two additional measures, flight deficiency training setback and flight deficiency attrition.

Intano, G. P., & Howse, W. R. (1994). Final validation of the Army aviator classification process. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Intano, G. P., Howse, W. R., & Lofaro, R. J. (1990). *Validation of the Army aviator Multitrack Assignment process*. Paper presented at the Department of Defense Human Factors Engineering Technical Group 24th Meeting, Fort Walton Beach, FL.

Intano, G. P., Howse, W. R., & Lofaro, R. J. (1991). Initial validation of the Army aviator classification process. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Initial Entry Rotary Wing Multi-Track (IERW-MT) flight training was initiated by the U.S. Army Aviation Center (USAAVNC) in 1988. Under this program flight students are assigned to complete their training in one of four rotary wing aircraft types by the eighty fifth day of flight school. The Army Research Institute Aviation Research and Development Activity (ARIARDA) developed a method to optimize aviator candidate classification for best probability of success. This method was implemented by USAAVNC in May, 1988. In this initial validation study 686 IERW-MT graduates, assigned to training tracks by the ARIARDA developed procedures, provided data to determine if the discriminant functions to be used would accurately match students with their actual assigned aircraft, and to determine if the functions could be enhanced by including other available performance data. This effort also explores the potential of the classification test battery for prediction of flight deficiency training setbacks, track flight performance, and common core training performance. The results strongly support the utility of the classification procedure for track assignment and indicate its applicability to performance prediction.

Intano, G. P., Howse, W. R., & Lofaro, R. J. (1991). The selection of an experimental test battery for aviator cognitive, psychomotor abilities and personal traits. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

In late 1986, the U.S. Army Aviation Center (USAAVNC) redesigned the Initial Entry Rotary Wing (IERW) course for aviator candidates. The new training is called IERW Multi-

Track (IERW-MT) and became operative in May 1988. The research problem for the U.S. Army Research Institute Aviation R&D Activity (ARIARDA) was to develop tests and procedures for selecting aviator candidates for one of four helicopters prior to training day 100. ARIARDA simultaneously pursued two avenues of research. On the one hand, available test instruments were considered and evaluated for their potential to discriminate among aviators. On the other hand, groups of Subject Matter Experts (SMEs) developed criticality-rated aviator candidate abilities and traits for specific operational helicopters. Extensive literature reviews and liaison with sister services and other agencies were accomplished. Four test instruments were evaluated for use. The underlying abilities, traits, and skills these batteries purported to measure matched the abilities, traits, and skills identified as necessary by the SMEs for each of their helicopters. Upon selection of the subtests contained in the ARIARDA experimental test battery, high-time aviators were given the experimental battery to develop scoring profiles for specific aircraft and to generate the data for the statistical analyses that resulted in the Preliminary Multi-Track Classification Algorithm.

Intano, G. P., & Lofaro, R. J. (1989). Army aviator classification by aircraft type. *Human Factors Society Bulletin, 32*, 2-4.

Intano, G. P., & Lofaro, R. J. (1990). Initial validation of the Army aviator candidate classification algorithm. *Human Factors Society Bulletin, 33*(4), 1-4.

Intano, G. P., Lofaro, R. J., & Howse, W. R. (1989). *Exploratory Research and Development and Preliminary Validation of the Army Aviation Classification Process*. Paper presented at the 31st Annual Military Testing Association Conference, San Antonio, TX.

In 1986, the U.S. Army Aviation Center (USAAVNC) redesigned the Initial Entry Rotary Wing (IERW) course of flight training. The new training course, IERW Multi-Track (IERW-MT), replaced the primary helicopter trainer, TH-55, with the UH-1. At training day (TD) 101, students would continue training by being tracked into one of four operational helicopters: UH-1, AH-1, OH-58, or UH-60. In 1987, the Army Research Institute Aviation R&D Activity (ARIARDA) was tasked to develop a process for assigning students to one of the four helicopters. The process required matching the skills, abilities and traits of individual students to the skills, abilities and traits necessary to successfully complete flight training in a particular helicopter. The assignment process also had to provide the highest potential for a successful aviation career in operational units. The assignment process requires application prior to TD 100, normally at about TD 85. Since only 18 months were available to conduct the research, ARIARDA simultaneously pursued two avenues of research. On the one hand, available tests were evaluated for their potential to discriminate among experienced aviators as well as students. On the other, highly experienced groups of aviators, using Small Group Analysis (SGA) techniques, identified the critically rated aviator skills, abilities and traits necessary for flying each helicopter.

Irvine, S., & Kyllonen, P. (Eds.). (2002). *Item Generation for Test Development*. Mahwah, NJ: Erlbaum.

Ivan, D. J., Tredici, T. J., Perez-Becerra, J., Dennis, R., Burroughs, J. R., & Taboada, J. (1996). Photorefractive keratectomy (PRK) in the military aviator: an aeromedical perspective.

Aviation, Space, and Environmental Medicine, 67(8), 770-776.

Refractive surgery to visually rehabilitate refractive errors of the eye continues to evolve at a significant pace and is here to stay. The surgical manipulation of the cornea by carefully planned incisions, as in radial keratotomy, represented the first procedure to evolve for the correction of ametropia and is an area of continued active development and improvement. However, many concerns mitigate against this procedure in the aeromedical arena. More recently, photorefractive keratectomy using laser technology to ablate and recontour the corneal surface has emerged as a viable modality. This paper explores the aeromedical factors surrounding this new revolutionary procedure and discusses the issues relevant to evaluating its applicability to the modern military aviator as well as reviewing results of the latest clinical trials currently in progress. The goal is to provide the aeromedical community with the fundamental information required to formulate aeromedical decisions and policy-making in regard to a new procedure that is certain to have tremendous impact on the selection of future aircrew candidates.

Ives, H. E. (1920). *Airplane Photography*. Philadelphia: J.B. Lippincott Company.

Jackman, W. J., & Russell, T. H. (1912). *Flying Machines: Construction and Operation*. Chicago: Charles C. Thompson Co.

Jacob, A. (1950). *Psychopathologie de l'aviateur*. Paris,: Librairie Le François.

Jacobs, P., & Southcote, A. (2006). *Domain-based aptitude testing for pilot selection*. Paper presented at the 48th Annual Military Testing Association Conference, Kingston, ON, Canada.

Jacobson, C. N., & Burns, C. A. (2005). An Assessment of the GoldenEye-50 Operator Control Unit. Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.

The GoldenEye-50, developed by Aurora Flight Sciences, was selected by the Defense Advanced Research Projects Agency as one of multiple candidates to provide the basic platform for the Organic Air Vehicle II program for expected integration into the U.S. Army‘s Future Combat System program. The GoldenEye-50 is a transportable (approximately 18 lb) unmanned aerial vehicle (UAV) with vertical take-off and landing capability. It is designed to carry a payload to support reconnaissance and chemical detection missions and can transform from a hover-and-stare mode to wing-borne flight as needed. In support of the Human-Robot Interaction Army Technology Objective, an assessment of the operator control unit (OCU) was conducted during a technical demonstration of the GoldenEye-50 held at Fort Knox, Kentucky, from 9 to 12 May 2005. The authors‘ primary objective was to reveal human factors engineering issues associated with the design of the OCU interface and to learn the tasks of a UAV operator, particularly with multi-mode flight capability of vertical and horizontal flight. From the observational data, potential issues and recommendations for the final OCU interface design accepted by the Army are presented.

James, J. A. (1985). *Canadian automated pilot selection system*. Paper presented at the 3rd Symposium on Aviation Psychology.

James, J. A. (1987). *An overview of the Canadian automated pilot selection system*. Paper

presented at the 27th Annual Military Testing Association Conference, Ottawa, ON, Canada.

Given the increasing complexity of modern military aircraft and the high costs associated with pilot training, the Canadian Forces (CF) has been examining methods of improving the assessment and selection of pilot candidates. Consistent with this objective, the CF has developed and is evaluating the Canadian Automated Pilot Selection System (CAPSS), an automated computerized test of complex psychomotor coordination based on flight simulation technology (James, 1985a; 1985b; 1985c). This paper describes CAPSS and outlines plans for its validation.

Jenkins, J. G. (1941). Selection and training of aircraft pilots. *Journal of Consulting Psychology, 5*, 228-234.

Perhaps the best key to psychological problems in aviation is offered by the opening sentence in a foreign flight-manual which reads: "It must be remembered that flight is an unnatural activity in man." True when it was written, it is more than ever true today. Today one must help to select and maintain men who will operate machines in three dimensions, machines that will climb too fast, accelerate and decelerate too rapidly, rise too high, operate under great extremes of temperature, fly when men cannot see, and cover an enormous amount of space during the period of a simple reaction-time. In wartime this is further complicated by the fact that enemies on the ground, on the sea, and in the air are quite likely to make lethal gestures during any of the maneuvers named.

Jenkins, J. G. (1943). Prediction of flight training performance by biographical data. *Journal of Aviation Medicine, 15*, 131-135.

Jenkins, J. G. (1945). Naval aviation psychology, I: The field service organization. *Psychological Bulletin, 42*, 631-637.

Jenkins, J. G. (1946). Naval aviation psychology, II: The procurement and selection organization. *American Psychologist, 1*, 45-49.

Jenkins, J. G. (1947). The future of research in Naval aviation psychology. In G. A. Kelly (Ed.), *New methods in applied psychology*. College Park, MD: University of Maryland.

Jenkins, J. G., Ewart, E. S., & Carroll, J. B. (1950). *The combat criterion in naval aviation (Report No 6)*. Washington, DC: National Research Council on Aviation Psychology.

Jensen, R. S. (1989). *Aviation psychology*. Aldershot ; Brookfield, USA: Gower Technical.

Jentsch, F., Bowers, C. A., Martin, L., Barnett, J., & Prince, C. (1997). *Identifying the knowledges, skills, and abilities needed by the junior first officer*. Paper presented at the Ninth International Symposium on Aviation Psychology.

Jernigan, A. J. (2003). *Selecting the best : World War II Army Air Forces aviation psychology* (Rev. ed.). Bloomington, IN: 1stBooks.

Jessup, G., & Jessup, H. (1971). Validity of the Eysenck Personality Inventory in Pilot Selection. *Occupational Psychology, 45*(2), 111-123.

Jinks, D. M. (1977). Cost analysis of attrition by Self-Initiated-Elimination (SIE) for Initial Entry Rotary Wing courses. Fort Rucker, AL: Directorate of Evaluation and Standardization.

Johansen-Berg, K., Prew, S.-J., & Lehman, C. (1999, December, 1999). Cathay Pacific The Heart of Asia. *Civil Aviation Training,* 8-17.

Johnson, C. D., & Zeidner, J. (1995). Differential Assignment Theory Sourcebook (pp. 76). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Johnson, H. M. (1920). Resume of research in the psychology of aviation during the year 1919. *Science, LI*(1323), 449-452.

Johnson, H. M. (1944). On the actual and potential value of biographical information as a means of predicting success in aeronautical training. Washington, DC: Civil Aviation Administration Airman Development Division.

Johnson, N., Fuller, R., & McDonald, N. (Eds.). (1995). *Aviation Psychology, Training and selection: Proceedings of the 21st Conference of the European Association for Aviation Psychology, EEAP, Vol. 2* (Vol. 2): European Association for Aviation Psychology.
This is the second of three volumes comprising the proceedings of the conference on psychology and aviation. Papers address crew resource management, air traffic control, personnel selection, psychometric testing, and pilot training techniques for conventional and advanced technology aircraft.

Johnson, R. H. (1917). Select Army aviators by test, not education. *Journal of Heredity, 8*, 425.

Johnston. (1989). *A review of airline sponsored ab initio pilot training in Europe*. Paper presented at the International Symposium on Aviation Psychology.

Johnston, N. (1995, 19 April). *Psychological testing of aircrew: Benefits and risks.* Paper presented at the Resting, testing, air quality and noise conference, London.
This paper reviews issues relating to the psychological testing of aircrew. The paper aims to clarify issues relating to the validity, reliability, and value of the psychological testing of aircrew. It is first suggested that the entire domain is characterized by terminological and methodological confusion. The economic and other benefits of psychological testing are contrasted with the potential risks, including abuse and the application of tests in circumstances for which they were never designed. Reference is also made to European cultural differences which may potentially impact the practical realities of psychological testing. (Author)

Johnston, N. (1999). Psychological testing and pilot licensing. *International Journal of Aviation Psychology, 6*(2), 179-197.

Johnston, N., McDonald, N., & Fuller, R. (1994). *Aviation psychology in practice*. Aldershot,

Hants, England & Brookfield, Vt.: Avebury Technical; Ashgate.

Johnston, N., Fuller, R., & McDonald, N. (Eds.). (1994). *Aviation Psychology: Training and Selection*. Aldershot: Avebury Aviation, Ashgate.

Johnston, N., Fuller, R., & McDonald, N. (Eds.). (1995). *Aviation Psychology: Training and Selection* (Vol. 2). Aldershot: Avebury.

Joint Directors of Laboratories. (1992). White paper on tri-service reliance in science and technology. Washington, DC: Joint Directors of Laboratories.

Jones, A. (1982). *Providing the man in the back seat*. Paper presented at the 24th Annual Military Testing Association Conference, San Antonio, TX.

Despite his passive-sounding name the Royal Navy Observer is a very active and important member of a helicopter crew. He acts as a navigator and tactical coordinator in 2- and 4-man helicopters. He operates variable depth sonar, radar, electronic warfare equipment, and weapons systems such as homing torpedoes, depth charges, and air to sea missiles. The Royal Navy has met various problems in recruiting suitable personnel, that is, in providing this important "man in the back seat." The majority of Observers join the Service on a Short or Medium Career engagement, and only a relatively small number come from amongst Full Career Officers. The Short/Medium Career Commission for aircrew in fact provides the majority of both Pilots and Observers in the Royal Navy. For Short/Medium Career Officers the training pattern until recently has been 8 months basic Officer training, twenty four weeks Basic Flying Training (100 flying hours in a fixed wing aircraft), Advanced Flying Training (27 flying hours in a helicopter), followed by 50 flying hours of Operational Flying Training. Over a seven year period Short/Medium Commission Officers have shown a 28% wastage rate during Officer training, of which half was voluntary. During Basic Flying Training (BFT) there was 29% wastage (40% of those entering), and 7% (16% of those entering) at Advanced Flying Training (AFT). The overall wastage has therefore been approximately two-thirds of those recruited. From the above-figures two major problem areas can easily be identified: voluntary wastage in Officer training and wastage in Basic Flying Training. Failure at this latter stage is predominantly (90%) ascribed to problems in the air (as distinct from ground school). Often trainees are described as "leaving some of their brains behind on the ground."

Jones, A. (1983). A survey of military pilot selection procedures in ten countries. London: Ministry of Defense, Navy Scientific Advisory Group.

Jones, D. H., & McAnulty, D. M. (1984). *An examination of ability requirements for various rotary wing missions*. Paper presented at the 28th Annual Meeting of the Human Factors and Ergonomics Society.

The increasing specialization of rotary wing missions and aircraft has precipitated a reanalysis of traditional strategies for assigning student aviators to one of four rotary wing missions: cargo, utility, aeroscout, or attack. Although previous research has suggested that certain abilities are appropriate for inclusion in a classification algorithm, there are no data to indicate that there are differences in the ability requirements (types or levels) for the four missions. This paper describes the results of several analyses designed to compare the ability

requirements of the four missions. Ability rating data, obtained from subject matter experts for each mission, were transformed using the Method of Successive Intervals (MSI) to remove systematic biases identified in the raters' distributions. Analyses of the transformed data indicate that there are no differences in the types or levels of abilities required to perform the most demanding tasks for each mission.

Jones, D. R., & Marsh, R. W. (2001). Psychiatric considerations in military aerospace medicine. *Aviation, Space, and Environmental Medicine, 72*, 129-135.

Jones, D. R., Marsh, R. W., Patterson, J. C., Sowin, T. W., Drummond, F. E., Orme, D. R., & Callister, J. D. (2000). Aviation Neurpsychiatry. Brooks AFB, TX: United States Air Force School of Aerospace Medicine.

Jones, L. V. (2007). Some lasting consequences of US psychology programs in World Wars I and II. *Multivariate Behavioral Research, 42*(3), 593-608.

Applied research in psychology not only has contributed directly to societal advances but often has fostered basic research as well. Prominent examples are the programs directed by Yerkes in World War I to develop the Army Alpha test and several programs in World War II, including The American Soldier that assessed soldiers‘ attitudes during the war; a program for selecting agents for the Office of Strategic Services; and the Aviation Psychology Program to select and classify applicants for flight training in the Army Air Forces. Highlights of these programs are presented here, with special attention given to by far the largest, the Air Forces program. After World War II, many of the hundreds of psychologist veterans became prominent research psychologists. Most became university professors. Among those who continued to work in applied settings was John Flanagan who had served as Chief of the Army Air Forces Psychology Branch. (After the war, Saul Sells succeeded Flanagan as Head of the Aviation Psychology program.) Flanagan founded the American Institutes for Research (AIR), the earliest mission of which was to select flight personnel for civilian airlines. Another part of the AIR mission was to enhance civilian air safety by assuring the widespread use of Flanagan‘s critical-incident procedures (or near-accident reports) that now serve to reduce accident rates in a variety of industries as well as in aviation.

Jorna, L. G. A. M. (1989). *Prediction of success in flight training by single- and dual-task performance.* Paper presented at the AGARD-CP -458 (21-1-21-10), Neuilly-Sur-Seine, France.

Jorna, L. G. A. M., & Visser, B. (1991). Selection by flight simulator: Effects of anxiety on performance *Human Resources Management Aviation*.

Judy, C. J. (1966). Potential value of educational background data in the selection and classification of military personnel. *Journal of Psychology, 62*, 195-200.

Kalagian, S. P. (1964). *Personnel aspects of the Army aviation program*. Paper presented at the 10th Army Human Factors Research and Development Conference, Fort Rucker, AL.

From a humble beginning in 1942 when light single engine civilian Cubs were pressed into service for reconnaissance and observation missions, Army aviation has experienced a

continuous growth toward a current requirement based on organizational structures in excess of aviators (1). These requirements do not include the airmobile test activities now in being at Fort Benning and Fort Riley nor the unprogrammed requirements that have been generated to support counter-insurgency operations in the major trouble-spots of the world.

Kalez, M. M., & Hovde, R. C. (1946). Pilots with repeated "pilot ineptitude" accidents. *Journal of Aviation Medicine, 16*, 370-375.

Kantor, J. E. (1985). *Development of an integrated pilot selection system*. Paper presented at the 27th Annual Military Testing Association Conference, San Diego, CA.

The Air Force Human Resources Laboratory (AFHRL) is conducting a multi-year research and development (R&D) program to improve procedures for selecting candidates for USAF Undergraduate Pilot Training (UPT). The principal goal of selection procedures for UPT is to screen out those candidates with low chances of completing training and/or becoming successful operational pilots. This is more important now than ever because the costs of each UPT eliminee have risen dramatically (approximately $64,000) and the operational mission in which USAF aircrews are employed has increased in complexity and difficulty. Therefore, improvements in identifying candidates who have the requisite abilities for success will both reduce the wasted costs associated with eliminations and help ensure that operational –pilots are capable of meeting the rigorous demands of today's military aerospace environment.

Kantor, J. E., & Bordelon, V. P. (1985). The USAF pilot selection and classification research program. *Aviation, Space, and Environmental Medicine, 56*(3), 258-261.

A multi-year research program to improve the selection of pilot trainees and the classification of student pilots for either fighter or heavy aircraft training is described. A battery of experimental tests measuring psychomotor skills, personality traits, and cognitive abilities is being given via computer prior to training. The subjects' performance in training and operational flying is then tracked and analyzed. The preliminary results and future directions of this ongoing program are discussed.

Kantor, J. E., & Carretta, T. R. (1988). Aircrew selection systems. *Aviation, Space, and Environmental Medicine, 59* (Supplement 11), A32-A38.

Kantor, J. E., & Ideen, D. R. (1979). *The Air Force female pilots program: An interim report*. Paper presented at the 21st Annual Military Testing Association Conference, San Diego, CA.

Kantor, J. E., Noble, B. E., Leisey, S. A., & McFarlane, T. A. (1979). Air Force female pilots program: Initial performance and attitudes. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Kaplan, H. (1965). Prediction of success in Army aviation training. Washington, DC: U.S. Army Personnel Research Office.

Beginning in 1955, the Deputy Chief of Staff for Personnel established requirements for the development of instrument to select officers as fixed-wing pilot trainees and enlisted men as arrant officer candidate rotary-wing p lot trainees. In 1963, the requirement was expanded to

provide for a consolidation of the separate program. Procedure: To meet the initial requirement, research programs were conducted involving the experimental testing of 2000 enlisted men, 1200 officers, and 1200 ROTC cadets. Particular attention was given to the development of measures to select enlisted personnel for rotary-wing training , including preflight (OCS) to prepare graduates for warrant officer commissioning. Pending completion of a long-range research effort, partial results were utilized to develop interim test batteries for operational use. Finally, current operational data and previous research findings were combined to provide a basis for a comprehensive selection program. Selection tests initially developed by the Air Force and modified for Army us were effective in predicting fixed-wing training success for officers and ROTC cadets. Selection tests developed by the U. S. Army Personnel Research Office were effective in predicting the success of enlisted applicants for warrant officer candidate preflight and rotary - wing training. A comprehensive set of Flight Aptitude Selection Tests (FAST) was developed which provides effective measurement of both fixed-wing and rotary-wing aptitude for applicants to warrant officer candidate aviation training and of both fixed-wing and rotary-wing aptitude for applicants to officer aviation training.

Kaplan, H. (1968). Evaluation of the Army Fixed-Wing Aptitude Battery in Selection for ROTC Flight Training. Alexandria, VA: Army Behavioral and Systems Research Laboratory.

The Army ROTC Flight Instruction Program was authorized by regulation in 1956 in order to provide basic ground and in-flight fundamentals to meet minimum requirements of the Federal Aviation Agency (FAA) and to qualify students for FAA private pilot certification. The objective was to create a reserve pool of qualified pilots who can be utilized in the event of a national emergency. ROTC flight training may further serve as a selection device and as useful preparation for the Active Army's flight training programs. The Army Fixed-Wing Aptitude Battery, AFWAB-1, was administered experimentally to samples of students applying for ROTC flight instruction during the years 1956-57, 1957-58, and 1958-59. The battery was then evaluated for effectiveness in discriminating between successful and unsuccessful trainees. On the basis of this research, AFWAB-1 was adopted for ROTC use in 1961.

Kaplan, H. (1973). Psychological testing programs in the U.S. Army. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Kassai, S., Shibata, Y., Ihara, R., & Kudo, A. (2004). Usefulness of New Aptitude Test Device and Methods for Pilot Performance and its Application in the Pilot Selection Procedure in JASDF. *Reports of the Aeromedical Laboratory, 44*(3), 41-59.

Kasteleijn-Nolst Trenite, D. G. (2005). Intermittent photic stimulation as an activation method for electroencephalographic screening of aircrew applicants. *Epilepsy & Behavior, 6*(1), 21-26.

Disqualifying criteria for aircrew in Europe (JAR-FCL 3) are, besides a diagnosis of epilepsy after the age of 5 and a history of episode(s) of disturbance of consciousness, epileptiform paroxysmal electroencephalographic abnormalities and focal slow waves. Intermittent photic stimulation (IPS) provokes in about 0.5% of healthy subjects (range 0-2%) a photoparoxysmal response and is most often the only abnormality (70-90%). The literature is scarce and shows great diversity in methodology. Standardized IPS with simultaneous video will not only allow collection of sufficient data for proper epidemiological studies, but can also reveal

clinical and often unnoticed or misinterpreted signs and symptoms like myoclonia, loss of consciousness, and occipital seizures with visual auras. The pilot (sleep deprivation, strong sunlight) and the traffic controller (stress, monitors) are more prone to visually induced seizures. Furthermore, the increasing exposure to potentially seizure-triggering visual stimuli might have its impact in a more indirect or cumulative way.

Kasteleijn-Nolst Trenité, D. G., & Vermeiren, R. (2005). The impact of subclinical epileptiform discharges on complex tasks and cognition: relevance for aircrew and air traffic controllers. *Epilepsy & Behavior, 6*(1), 31-34.

Subtle seizures consisting of brief alteration of consciousness with or without automatisms may go unnoticed in daily life, but can be detected more easily with electroencephalographic (EEG)/video recordings. Generalized and partial epileptiform EEG discharges can nevertheless be subclinical (subclinical epileptiform discharges, SEDs). When appropriate complex tasks are presented, it has been shown that even very short SEDs of 0.5 second disrupt cognition. In daily life this has been shown during automobile driving: half of the subjects showed significant deviations in lateral position of the car during SEDs and made more errors in an attention task while driving. Individual differences in the cognitive effects of SEDs are, however, striking and may be partly due to interaction between level of performance and frequency of spontaneous EEG discharges, as has been shown in another driving study: about 75% of subjects showed suppression of SEDs by driving, which is a combination of sensory, mental, and motor activity. Not only can SEDs negatively influence performance, but in some cases mental activities can provoke epileptiform discharges. It is important to realize that these mechanisms exist and that only detailed EEG studies can clarify these issues. In air traffic controllers, brief alterations of consciousness and cognitive impairment have occurred but cannot be accepted for safety reasons; therefore, Eurocontrol has used the EEG as a screening tool since 1995.

Katz, L. C. (2006). *Development of an Army aviator selection instrument*. Paper presented at the Department of Defense Human Factors Engineering Technical Advisory Group

Katz, L. C., & Howse, W. R. (2005). *Selection instrument for flight training*. Paper presented at the Department of Defense Human Factors Technical Advisory Group 52nd Meeting.

Kaufman, B. (1943). Notes on classification, selection and training. *Journal of Aviation Medicine, 14*(6), 383-385.

Kaufman, C. J. (2000). Pilot recruitment of african-americans: An examination of a negative trend. Maxwell Air Force Base, AL: Air Command and Staff College, Air University.

Kay, G., Dolgin, D., Hoffmann, C., & Langleier, M. (1999). *Identification of cognitive, psychomotor and psychosocial skill demands of UCAV operators*. Paper presented at the Second Annual Conference: Unmanned Combat Aerial Vehicles II (UCAV's), London.

Kay, G., Dolgin, D., Wasel, B., Langelier, M., & Hoffman, C. (1999). Identification of the Cognitive, Psychomotor, and Psychosocial Skill Demands of Uninhabited Combat Aerial Vehicle (UCAV) Operators. Patuxent River, MD: Naval Air Systems Command.

Kay, G. G., & Horst, R. L. (1988). Methods for evaluating cognitive function: A review of mental status tests, neuropsychological procedures, and performance-based approaches. Oklahoma City, OK: Civil Aeronautical Medical Institute.

Keener, R. A. (2003). *Use of Multivariate Techniques to Validate and Improve the Current USAF Pilot Candidate Selection Model.* MS, Air Force Institute of Technology, Wright-Patterson AFB, OH.

Kelley, C. R., Bishop, E. W., Beum, C., & Dunlap, J. W. (1951). Pilot selection: An evaluation of published techniques.: Office of Naval Research.

Kelley, T. L. (1919). Principles underlying the classification of men. *Journal of Applied Psychology, 3*, 50-67.

The opportunity to appear before this body suggested making a report upon some one of the phases of army work with which I have been connected, or of presenting certain conclusions and principles which have been developed or strengthened by my total War Department experience I have chosen the latter course because I believe my report will be of more value if I present some of the principles of selection underlying war procedure which are equally applicable to peace conditions. My experience in connection with tests for illiterates, trade tests, and the selection of ground and flying school men, entirely supports the conclusions which will be reported, but I shall choose another field, that of selection of officer material from S. A T C. units, to illustrate the points made, because, in my judgment, the principles adopted in the selection and classification of S. A. T. C. men are in advance of those used in any other field of classification. The problem of classification in the Students Army Training Corps followed directly from its main purpose which was to provide for the securing of material fit for officer training.

Kelly, G. A. (Ed.). (1947). *New methods in applied psychology.* College Park, MD: University of Maryland.

Kellum, W. E. (1943). Recent developments in selection of candidates for aviation training. *American Journal of Psychiatry, 100*, 80-84.

Kellum, W. E. (1948). An early attempt to evaluate psychological factors for flight training. *Contact, 6*, 232-235.

Kemp, E. H., & Johnson, A. P. (Eds.). (1947). *Psychological Research on bombardier training. Report No. 9*. Washington, DC: U.S. Government Printing Office.

Kennedy, R. S. (1975). Motion sickness questionnaire and field independence scores as predictors of success in naval aviation training. *Aviation, Space, and Environmental Medicine, 46*(11), 1349-1352.

The present report has shown that a motion sickness questionnaire can be used to predict susceptibility to motion sickness or flight training success, depending on the items scored. There is a discussion of the theory that motion sickness results from conflicting perceptual inputs. This theory is related to aircraft operating conditions. Scores on a personality test which appear to be

related to similar perceptual phenomena are related to aviation success. One phenotype, field independence, seems to be promising in this regard. In addition to use of this finding in aviator selection, it is felt that studies of this trait, as it relates to an ability to reconcile conflict and to motion sickness insusceptibility, should be conducted.

Kennedy, R. S., Lane, N., & Jones, M. B. (1996). An automated test battery for advanced aviator assessment. Final Technical Report. Orlando, FL: Essex Corp.

We stated in our Phase I proposal that it was "... our intention to be fully responsive to this solicitation and to create '...a new test battery (and new tests)...' by focusing in Phase I on ability related aptitudes to determine whether these computerized tests add new variance to the existing tests, as well they might." In Phase I we tested an automated battery which combined tests from three different computerized test domains with which we had extensive experience: 1) cognitive tests; 2) temporal acuity (visual temporal information processing) tests; and 3) psychomotor tests including video games. These tests were all: written in "C", validated against simulated aviation and space shuttle landing tasks, could each be fielded immediately so that plans for networking and field testing could incorporate actual lessons learned from empirical evidence both about content of behavioral measures, and also about the difficulties to be encountered in attempting to test at remote sites. Data were collected on 120 aviation candidates. We examined the psychometric properties of measures from the automated battery, and related those measures to tests and composites from the Aviation Selection Test Battery (ASTB). Analyses indicated that: a) Tests in the new automated battery were generally of adequate to high reliability. b) Correlations between the automated battery and ASTB variables were, with a few exceptions, not large but in the expected directions, suggesting that tests in the automated battery do not duplicate the variance measured by the ASTB, and could thus potentially augment the predictive power of the ASTB. c) Relationships among the Spatial Apperception Test (SAT) and several of the temporal acuity tests indicate that temporal factors may be involved in SAT performance. At the same time, there is considerable reliable variance unique to each domain, again implying the potential for augmentation of the ASTB by measures from the automated battery. Serendipitously, because of a computer malfunction, data on the automated battery were collected on two different computers. In the course of analysis, it was determined that data from the two machines differed on several of the tests in the automated battery. The implications of these differences for future plans networked, distributed selection testing were discussed, and it was suggested that possible effects on testing outcomes resulting from computer characteristics should be given additional emphasis, both in the Phase II effort which would be proposed by Essex and in the Navy's current plans for implementation of networked selection.

Kennedy, R. S., Lane, N. E., Bramble, W. J., Jr., & Drexler, J. M. (1998). *An automated test battery for advanced aviator assessment*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society.

A study was conducted to determine whether a number of computerized tests would add new variance to a paper-and-pencil selection battery, the U.S. Navy‘s Aviation Selection Test Battery (ASTB). The computerized tests came from three different domains: 1) cognitive tests; 2) temporal acuity (visual temporal information processing) tests; and 3) psychomotor tests including video games. These tests were all written in “C” and had been validated against simulated aviation and space shuttle landing tasks. Data were collected on 120 aviation candidates. Analyses indicated that: a) Tests in the new automated battery were generally of

adequate to high reliability; b) Correlations between the automated battery and ASTB variables were, with a few exceptions, not large but in the expected directions, suggesting that tests in the automated battery do not duplicate the variance measured by the ASTB, and could thus potentially augment the predictive power of the ASTB; and c) Relationships among the Spatial Apperception Test (SAT) of the ATSB and several of the temporal acuity tests indicate that temporal factors may be involved in SAT performance. At the same time, there is considerable reliable variance unique to each domain, again implying the potential for augmentation of the ASTB by measures from the automated battery.

Kerrick, H. S. (1918). *Military and Naval America*. New York: Doubleday, Page & Co.

Kevles, D. J. (1968). Testing the Army's Intelligence: Psychologists and the Military in World War I. *The Journal of American History, 55*(3), 565-581.

Kilcullen, R. N., Clifton, T. C., & Thor, K. K. (1993). *Assessing the Validity and Fakability of Various Types of Biodata Items*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

A critical task for most organizations is the ability to select qualified employees for vacant positions. Consequently, much effort has been spent developing tests that predict future job performance. One of the more popular selection methods is the biodata questionnaire. Biodata questionnaires are self-report multiple-choice instruments that measure prior behavior and reactions to life events relevant to job performance. Me&analyses of the selection literature by Dunnette (1972), Hunter & Hunter (1984), Schmitt, Gooding, Noe, & Kirsch (1984), and Reilly & Chao (1982) reveal that biodata effectively predicts a wide variety of performance criteria (e.g., ratings of overall performance and advancement potential, commendations, sales volume, bonuses), yielding validities in the .39s to .40s.

King, J. E. (1946). *The modification-revision method in psychomotor measurement, a minor study in aviation psychology*. Chicago, IL.

King, J. E. (1947). *The modification-revision method in psychomotor measurement*. n.p.

King, N. W., & Eddowes, E. E. (1976). Similarities and differences among superior, marginal, and eliminated undergraduate pilot training students. Williams Air Force Base, AZ: Air Force Human Resources Laboratory.

King, R. E. (1999). Aerospace clinical psychology and its role in serving practitioners of hazardous activities. *Human Performance in Extreme Environments, 4*(1), 109-111.

King, R. E. (1994). Assessing aviators for personality pathology with the Millon Clinical Multiaxial Inventory (MCMI). *Aviation, Space, and Environmental Medicine, 65*, 227-231.

King, R. E. (1995). *Developing selection and cockpit assignment criteria based on the experience of NASA*. Paper presented at the Life Sciences and Space Medicine Conference, Houston, TX.

King, R. E. (1999). *Aerospace Clinical Psychology*. Aldershot, Hants, England ; Brookfield, Vt.: Ashgate.

King, R. E., & Flynn, C. F. (1995). Defining and measuring the 'right stuff': Neuropsychiatrically enhanced flight screening (N-EFS). *Aviation, Space, and Environmental Medicine, 66*(10), 951-956.

King, R. E., McGlohn, S. E., & Retzlaff, P. D. (1997). Female United States Air Force pilot personality: The new right stuff. *Military Medicine, 162*, 695-697.

King, R. E., Retzlaff, P. D., & Orme, D. R. (2001). A comparison of US Air Force Pilot Psychological Baseline Information to safety outcomes. Kirtland Air Force Base, NM: Air Force Safety Center.

King, R. E., Schoffield, G. L., Patterson, J. C., Besich, W. J., & Jackson, W. G. (1994). Validation of MMPI Scales for Personality Disorders: A "Pilot" and Other Aviator Study. Brooks Air Force Base, TX: Armstrong Laboratory.

The Minnesota Multiphasic Personality Inventory (MMPI), long a psychometric staple, has not been readily compatible with the third Diagnostic and Statistical Manual of Mental Disorders (DSM-III and DSM-III-R; 1, 2) . Morey, Waughr and Blashfield (8) rationally! empirically constructed MMPI personality disorder scales to assess these DSM-III Axis II conditions, but adequate outpatient validation remains to be accomplished. The present study, based on 104 male aviators referred to a consultation service, found significant ($p < 0.001$) positive correlations in nine of 11 personality disorder scale comparisons between the MMPI and the Millon Clinical Multiaxial Inventory (MCMI) , a test that attempts to more closely correspond to the criterion of the DSM-III/DSM-III-R. The Antisocial and Compulsive personality disorder scales failed to significantly correlate. The MMPI personality disorder scales; however, did not significantly identify which subjects had psychiatrically noted maladaptive personality traits.

Knapp, B. G., & Tillman, B. (1998). *Job skill assessment software system*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society.

The US Army Research Laboratory is developing the Job Assessment Software System (JASS). JASS is a computer program to define and measure human aptitudes required to do a job. A person familiar with the job (designer, worker, trainee, etc.) uses JASS by answering ~~y~~es" or ~~n~~o" to a series of questions. The answers identify the aptitudes required. For each required aptitude, JASS presents a 7-point scale to rate the aptitude level. JASS is based on the work of Dr. Edwin Fleishman (Fleishman & Quaintance, 1984) of George Mason University. This paper will describe JASS and its recent applications and will also describe current and anticipated efforts to further develop and improve the JASS tool.

Knapp, D. J. (1987). Final report on a national cross-validation of the computerized adaptive screening test (CAST). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The Computerized Adaptive Screening Test (CAST) is used by Army recruiters to predict

prospective applicants' subsequent performance on the Armed Forces Qualification Test (AFQT). A modified version of the CAST software was used in 60 recruiting stations across the country from January through December 1985 to collect CAST item-level performance information. Screening test data were matched to applicant records from Military Entrance Processing Stations to obtain ASVAB scores and relevant demographic information. The cross-validated, corrected correlation between CAST and AFQT scores is .83. CAST's ability to predict important AFQT performance categories and Army Aptitude Area scores was also examined. Alternative subtest lengths were evaluated and item bank characteristics were described.

Knapp, D. J., Burnfield, J. L., Sager, C. E., Waugh, G. W., Campbell, J. P., Reeve, C. L., . . . Heffner, T. S. (2002). Development of Predictor and Criterion Measures for the NCO21 Research Program. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Knapp, D. J., Pliske, R. M., & Elig, T. W. (1987). The computerized adaptive screening test(CAST): An examination of test validity and test fairness. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The Computerized Adaptive Screening Test (CAST) is used by Army recruiters to predict prospective applicants' (i.e., prospects') performance on the Armed Forces Qualification Test (AFQT). CAST performance data were collected from 60 recruiting stations across the country throughout calendar year 1985. These data were matched to applicant tapes from Military Entrance Processing Stations (MEPS) to obtain AFQT scores and relevant demographic information. Data analyses indicate that CAST is quite good at predicting AFQT scores for the entire sample and for examinees grouped by sex and race (black or white). When corrected for restriction in range, the cross-validated validity estimate based on the whole sample is .86. Race and sex differences in prediction exist, but these differences are minor and they correspond to those differences found with most cognitive ability tests. CAST's accuracy at predicting subsequent classification into important AFQT categories (i.e., 1-3A and 1-3B) is also discussed.

Knapp, D. J., Waters, B. K., & Heggestad, E. D. (2002). Investigations Related to the Implementation of the Assessment of Individual Motivation (AIM). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Knappen, T. M. (1920). *Wings of War*. New York: G.P. Putnam's Sons.

Knoell, D. M. (1956). Relationships between attitudes of bomber crews in training and their attitudes and performance in combat. Randolph Air Force Base, TX: Air Force Personnel and Training Research Center.

In research on bomber crew training and proficiency, an effort has been made to develop economical, reliable, and valid measures of attitudes exhibited in various situations, and to determine the relationship of such attitudes to crew proficiency. The present study as made to assess the stability of crew attitudes from the training to the combat situation. The study was designed also to provide additional information concerning; (a) relationships found in an analysis of 1952 combat crew attitudes and crew performance , and (b) the combat attitude scales used in that study.

Kobierski, B. (2004). Hierarchical Goal Analysis and Performance Modelling for the Control of Multiple UAVs/UCAVs from an Airborne Platform. Vol 1. Ottawa: Defense Research and Development Canada.

Early feedback from the operation of Uninhabited Air Vehicles (UAVs) indicates that improvements in the operator interface aspects of these emerging systems would reap significant gains in system performance and effectiveness. This applies to both effective control of UAVs as well as management of data and dissemination of the associated information. The Canadian Forces (CF) is pursuing the introduction of UAVs, and while such platforms may provide an enormous amount of data, the management of data to support effective human decision making is still an issue. Various levels of automation have been suggested as a way of addressing the problem including Intelligent/Adaptive Interfaces (IAIs) for decision support. IAIs are intended to manage information dynamically and provide the right data and information to the right people, at the right time, to support effective decision making. The work reported in this paper investigated the efficacy of IAIs in an operational situation. The selected environment involved UAV operations in support of counter terrorist activities with the IAI modelled as part of the UAV tactical workstations of a modernized CP140 aircraft. In order to produce an analysis of UAV operations which are relevant to CF UAV implementation plans, a one hour mission scenario was developed which reflected a portion of the upcoming Canadian Forces Experimentation Centre (CFEC) Atlantic Littoral Intelligence, Surveillance and Reconnaissance Experiment (ALIX) program. In order to facilitate the development of a performance model implemented in an Integrated Performance Modelling Environment, a Hierarchical Goal Analysis and Operational Sequence Diagrams were prepared for the scenario. The model was run in two modes: one assuming the operators used a conventional interface and the second assuming interface automation using an IAI. The difference between mission activities without automation (IAI OFF) and with automation (IAI ON) was reflected in the time to complete critical task sequences and in other measures of performance. It was concluded that the operational control of UAVs from an airborne platform was a complex task and workload increased during use of multiple disparate UAV assets. The use of a workstation, which incorporates an IAI mode, permitted operators to continue working under high time pressure, resulting in upper level goals being achieved in reduced time.

Koerth, W. (1922). A pursuit apparatus. *Psychological Monographs, 31*, 228-292.

Kohen, A. I. (1984). Attrition from military and civilian jobs: Insights from the national longitudinal surveys. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

An objective of this paper is to provide a literature review economic and non-economic reasons for attrition from military and civilian jobs, and to develop and calibrate a multivariate model of attrition. The stipulated model relates attrition from first job to civilian and military pay, educational levels of servicemen, socioeconomic status of parents, job satisfaction, age, race and perceived locus of control of an individualistic serviceman. The study used data from the National Longitudinal surveys of youth from 1966 to 1979. It concludes that attrition rates in the military can be reduced by increasing military wages, particularly in the lower rungs of the pay ladder, matching job requirements with education levels and increasing job satisfaction in the Military Occupational Specialties of the seperatees.

Kokorian, A., & Da Costa, M. P. (2008). *On the transportability of a computerised test battery for the selection of pilots*. Paper presented at the 50th Annual International Military Testing Association Conference, Amsterdam, Netherlands.

Kokorian, A., & Valsler, C. (1999). *Computer-based assessment for aircraft pilot: The Pilot Aptitude Tester (PILAPT)*. Paper presented at the 41st International Military Testing Association Conference, Monterey, CA.

Kokorian, A., & Valsler, C. (2004). *Generalisability of the psychometric properties of a pilot selection battery*. Paper presented at the 46th International Military Testing Association Conference, Columbus, OH.

Kokorian, A., Valsler, C., Tobar, J. C., & Ribero, R. B. (2004). *Generalisability of the criterion validity for a pilot selection battery*. Paper presented at the 46th Annual International Military Testing Association Conference, Brussels, Belgium.

Kokorian, A., Vasler, C., & Burke, E. (2003). *International validation of a computerised testing suite for pilot selection*. Paper presented at the 6th Australian Aviation Psychology Symposium, Sydney, Australia.

Koonce, J., & Berry, G. A. (1980). *Comparison of males and females in the prediction of basic flight performance.* Paper presented at the Seventh symposium on Psychology in the Department of Defense. U. S. Air Force Academy, Colorado Springs: Department of Behavioral Sciences and Leadership.

Koonce, J. M. (1974). Effects of ground-based aircraft simulator motion conditions upon prediction of pilot proficiency. Savoy: Aviation Research Laboratory, University of Illinois.

Koonce, J. M. (1979). Predictive validity of flight simulators as a function of simulator motion. *Human Factors, 21*(2), 215-223.

Ninety multi-engine instrument rated pilots were assigned to no motion, sustained linear scaled down analog motion, and washout motion in a GAT II simulator for determining the effects of degree of motion upon the predictive validity of flight simulators. Five instrument and five contact maneuvers were flown in the simulator followed by flight in a Piper Aztec aircraft. Performances were recorded by two observers and the interobserver reliability coefficients were 0.962 and 0.919 for instrument maneuvers and 0.879 and 0.613 for contact maneuvers in the simulator and aircraft, respectively. The condition of no motion resulted in greater error than the other two groups in the simulator, but there were no significant differences in the aircraft. Correlations of aircraft performance from the simulator maneuvers were 0.763 (no motion), 0.911 (sustained motion), and 0.651 (washout motion). Simulator motion did not result in better aircraft performance, and higher predictive validity was found with very basic sustained motion.

Koonce, J. M. (1982). Validation of a proposed pilot-trainee selection system. *Aviation, Space, and Environmental Medicine, 53*, 1166-1169.

In this article, the authors propose adding the aircrew psychomotor test (APT) to the Air Force Officer Qualifying Test (AFOQT; Form N) in an effort to reduce the number of cadets who fail to complete flight training. The APT consists of two psychomotor tasks. For the first task, subjects are required to track a target using two hand controls. The second task introduces the use of foot pedals. The subjects are required to use the hand controls and the foot pedals to keep a cross centered on the crosshairs that split the screen in half. Approximately 200 cadets from the Air Force Academy's classes of 1978 and 1979 were administered the AFOQT and the APT. They were ranked according to their scores and all who failed to score above the cut-off score were identified. All subjects were allowed to participate in flight training. After completion of flight training, their training performance was compared with their scores on the AFOQT and the APT. Using the APT as the screening device, 9.3 percent of the pilot-qualified cadets in the class of 1978 would have been denied access to pilot training, but 83 percent of these cadets would have succeeded; 6.0 percent of the class of 1979 would have been denied training, but 91.6 percent of these cadets would have succeeded. The correlations between the APT scores and UPT pass/fail were -.04 (class of '78) and -.09 (class of '79). Results of the analyses using the AFOQT were approximately the same as those obtained using the APT. Thus, neither the AFOQT or the APT discriminated very well between those who passed flight training and those who did not.

Koonce, J. M. (1984). A brief history of aviation psychology. *Human Factors, 26*(5), 499-508.

This paper presents an overview of the field of aviation psychology from its pre- World War I beginnings to current problems and opportunities for today's aviation psychologists. This brief survey covers some of the more significant early activities of aviation psychologists in the United States and Europe.

Koonce, J. M. (1998). *Effects of individual differences in propensity for feedback in the training of ab initio pilots*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society.

One hundred and fifty persons answered a questionnaire measuring self-esteem, propensity for feedback, self-efficacy, and certain demographic information. Subsequently, the students completed the Basic Flight Instruction Tutoring System (BFITS), a series of fully-automated criterion-referenced lessons designed to teach a person how to fly an airplane. BFITS provided feedback whenever student performance on monitored variables approached the limits of acceptable performance. After BFITS the students entered the traditional flight training program. Flight time prior to the first solo flight, landings before first solo, and total time to the private pilot certificate were obtained. Individual needs for feedback were significant factors of performance in the BFITS training and its transfer to the aircraft. Because of the interaction between individual propensity for feedback and training performance an individually adaptive feedback methodology is proposed.

Koonce, J. M., & McCloy, T. M. (1980). *Cognitive styles and the acquisition of a complex aerial maneuver.* Paper presented at the 24th Annual Meeting of the Human Factors Society.

Approximately equal number of male (45) and female (43) Air Force Academy cadets learned a complex aerial maneuver (chandelle) on a desk-top flight simulator. These cadets had participated in a previous experiment (Koonce & Berry, 1980) where they were given a battery of tests which tapped several cognitive and perceptual-motor areas. Of special interest in the

present study was the relationship of the various cognitive factors to the rate of acquisition of the complex aerial maneuver. Prior to the introduction of the complex maneuver all subjects were trained to criterion level on four basic instrument flight maneuvers (Koonce & McCloy, 1980). Then they learned how to fly the complex maneuver with the number of trials required to reach criterion performance as the dependent variable. Results indicated cognitive factors were very significant in predicting complex maneuver performance. Additionally, individually tailoring the regression equations by sex as opposed to utilizing a general overall regression equation greatly enhanced predictive capability.

Koonce, J. M., Moore, S. L., & Benton, C. J. (1995). *Initial validation of a basic flight instruction tutoring system (BFITS)*. Paper presented at the 8th International Symposium of Aviation Psychology, Columbus, OH.

Korolev, V. V., Opanasenko, V. V., Levit, I. R., Levit, A. I., & Kovalova, A. I. (2000). *Resistance to Information Stress as an Innate Feature and Prognostic Criterion in Professional Selection of Fighter Pilots and Flying Control Officer*. Paper presented at the 42nd Annual International Military Testing Association Conference.

The paper deals with individual differences of fighter pilots and flying control officers according to tension of central regulation mechanism during an experimental test simulating an operating activity. It shows and describes the human genotype dependent quality of the central nervous system structure to process information flows of any intensity and density. It develops a selection procedure for flying control officers working in dynamic information flow conditions according to individual human central nervous system ability to process information and resist information stress.

Kowal, D. M. (1977). Psychophysiological model for the prediction of performance. Natick, MA: USA Research Institute for Environmental Medicine.

Kreinkamp, R. A., & Luessenheide, H. D. (1985). Similarity of personalities of flight instructors and student pilots: Effect on flight training time. *Psychological Reports, 57*, 465-466.

The authors note that a wide range of factors influence the number of flight training hours necessary for obtaining a pilot's certificate. Sometimes a student reaches a learning plateau, and it is necessary for that student to change instructors before he or she is able to complete their training. The purpose of this study was to explore whether a significant relationship exists between differences in personality characteristics of instructors and those of their students and the number of flying hours required to complete flight training. The Myers Briggs Type Indicator (MBTI) was administered to 22 male and 10 female students and their instructors after completing flight training. Correlations were then computed between the difference scores of students and instructors on each of the MBTI scales and the number of flying hours required to complete training. No significant correlations were found for the Sensing/Intuition, Thinking/Seeing and the Judgment/Perception scales for either men or women. The correlation between number of flight hours and the difference score on the Extrovert/Introvert scale was .37 a < .05) for men. A moderate correlation was found for women between flying hours and the difference score on the Sensing/Intuition scale, but this correlation was non-significant (mostly likely due to a lack of power).

Kreisher, O. (2007, January). Rise of the Helicopter. *Aviation History,* 38-47.

Krumboltz, J. D., & Christal, R. E. (1957). Predictive validities for first-year criteria at the Air Force Academy. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Krumboltz, J. D., & Christal, R. E. (1957). Relative pilot aptitude and success in primary pilot training. *Journal of Applied Psychology, 41*, 409-413.

Kubala, A. L., Jr. (1959). Adaptability screening of flying personnel. *U.S. Armed Forces Medical Journal, 10*, 815-842.

Kubisiak, C., & Katz, L. (2006). U.S. Army aviator job analysis. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

This report describes the job analysis performed by The U.S. Army Research Institute for the Behavioral and Social Sciences Rotary Wing Aviation Research Unit (ARI RWARU) It was part of a larger research project to develop and validate a selection system for U.S. Army rotary wing aviators, called Selection Instrument for Flight Training (SIFT). The activities performed by Army aviators and the personal attributes required to perform those activities were examined. This job analysis helped identify predictor measures subsequently used to validate the prototype SIFT test battery.

Kunkle, E. C. (1946). The psychological background of "pilot error" in aircraft accidents. *Journal of Aviation Medicine, 17*, 533-567.

Kylonnen, P. C., & Christal, R. E. (1988). Cognitive modeling of learning abilities: A status report of LAMP. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Kylonnen, P. C., & Shute, V. J. (1988). Taxonomy of learning skills. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Lager, C. (1974). *Pilot reliability : reliability of human components in technical systems discussed as a function of workload, provocations and individual differences.* Thesis, Royal Institute of Technology, Stockholm., Stockholm.

Lambirth, T. T., Dolgin, D. L., & Carretta, T. R. (1989). *Selected personality characteristics of student naval aviators and student naval flight officers*. Paper presented at the Euro-NATO Aircrew Selection Working Group 12th Meeting, London.

This study examined personality differences between student naval aviators, student naval flight officers and a normative college sample using the Tri-Dimensional Personality Questionnaire (TPQ). The TPQ is a 100 item true-false questionnaire designed to assess several adaptive stimulus-response characteristics of personality proposed by an integrated biosocial theory of personality. It measures three dimensions: Novelty Seeking (activation), Harm Avoidance (inhibition) and Reward Dependence (maintenance) [these dimensions correspond to the dopamine, serotonin and norepinephrine neural systems, respectively]. The authors hypothesized that personality characteristics, psychomotor skills and cognitive abilities play a significant role in the selection of aviation as a career goal. Thus, there should be both

similarities and differences in personality characteristics between pilots and flight officers. One hundred twenty nine aviation candidates from the U.S. Navy flight training program were used as subjects. Seventy-nine were student naval aviators and 50 were student naval flight officers. Three hundred twenty-six college students comprised the normative group. A one-way analysis of variance indicated that there were significant differences between the groups in Novelty Seeking and Harm Avoidance. Specifically, pilot candidates scored higher in Novelty Seeking than the normative group, and they scored lower than flight officer candidates and the normative sample in Harm Avoidance. The authors conclude that student naval aviators and student naval flight officers are likely to pursue novel and unfamiliar experiences and to appear calm and uninhibited under normal circumstances. They characterize the results of their study as being a "snapshot" taken at that point of time between finishing basic officer training and the beginning of flight training.

Lambirth, T. T., Dolgin, D. L., Rentmeister-Bryant, H. K., & Moore, J. L. (2003). Selected personality characteristics of student naval aviators and student naval flight officers. *International Journal of Aviation Psychology, 13*(4), 415-427.

The Tridimensional Personality Questionnaire and the Hand Test were administered to 129 naval aviation student (79 student naval aviators and 50 student naval flight officer) candidates while they were waiting to begin basic flight training. Results indicated that, although pilot and flight officer candidate scores departed significantly in the same direction from normative data, there were few significant differences between the 2 groups on personality dimensions. However, both groups were significantly different from normative data on some dimensions. Possible interpretations of the data are discussed.

Lambirth, T. T., Gibb, G. D., & Alcorn, J. D. (1986). Use of a Behavior-Based Personality Instrument in Aviation Selection. *Educational and Psychological Measurement, 46*(4), 973-978.

This study evaluated a behavioral-based personality instrument currently used by a branch of the United States Armed Forces in their experimental aviation selection battery. The instrument, the Dot Estimation Task (DOT), was designed to measure compulsiveness versus decisiveness. The reliability and validity of this experimental instrument was evaluated. One hundred and fifty three university undergraduate students were administered the DOT and either of two paper-and-pencil compulsivity instruments in a counterbalanced design. Four weeks later, 90 subjects were retested on the DOT and the alternate compulsivity instrument. The results indicate that the DOT has a test-retest reliability of .64 but has no relationship to either compulsivity measure.

Lamont, G., & Sweetser, A. (1920). *Opportunities in Aviation*. New York: Harper and Bothers.

Lance, C. E., Stewart, A. M., & Carretta, T. R. (1993). Refinement of scoring procedures for the Basic Attributes Test (BAT) battery. Brooks Air Force Base, TX: Armstrong Laboratory.

The Basic Attributes Test (BAT) is a multiple aptitude computer-based battery designed to measure individual differences in psychomotor coordination, cognitive abilities, personality, and attitudes. The Air Force plans to operationally implement the BAT as a pilot candidate selection instrument in the near future. Scores from the Air Force Officer Qualifying Test, BAT, and biographical information will be combined in a new pilot candidate selection composite to

predict undergraduate pilot training outcomes. Although much useful research has been done in the BAT battery, the need for additional psychometric research to improve test scoring procedures and predictive efficiency was identified. The purpose of this study was to investigate (a) the internal consistency of item-level test scores, (b) the effects of alternative scoring procedures (e.g., treatment of outliers, data transformations, alternate scoring algorithms) on internal consistency and validity, and (c) the factor structure of the BAT. Results showed that (a) internal consistencies of most BAT scores are acceptable, indicating that the constructs are being measured reliably, (b) neither censoring outlying data points nor transforming data had a significant impact on internal consistency or validity of BAT scores, (c) few alternative scoring procedures improved BAT score validity, (d) test scores relate to a meaningful factor structure, and (e) BAT scores can be combined into an efficient model for the prediction of undergraduate pilot training performance.

Lance, C. E., Stewart, A. M., & Carretta, T. R. (1996). On the treatment of outliers in cognitive and psychomotor test data. *Military Psychology, 8*(1), 43-58.

Authors of many statistical texts and review articles have pointed to the possible adverse effects that outliers can have on the calculation of sample statistics and have suggested several methods for detecting and treating outliers. We investigated two different methods-data censoring and transformation-for treating outliers in aptitude test data at the item level and total-score level and their effects on the internal consistency and predictive validity of six computerized tests being evaluated by the U.S. Air Force. Results from our sample of more than 2,000 pilot training candidates indicated that neither outlier treatment method at either level of analysis had significant effects on the tests' internal consistencies or predictive validities. Possible reasons for these findings include the frequency with which outliers occur and the robustness of linear modeling methods.

Lanchester, F. W. (1916). *Aircraft in warfare: The dawn of the fourth arm*. London: Constable and Company Limited.

Lane, G. G. (1947). Studies in pilot selection. I. The prediction of success in learning to fly light aircraft. *Psychological Monographs, 61*(5), 1-17.

Lane, G. G., & Greene, R. R. (1947). *Studies in pilot selection*. Washington,: American Psychological Association.

Lane, N. E., Oberman, A., Mitchell, R. E., & Graybiel, A. (1966). The thousand aviator study: Smoking history correlates of selected physiological, biochemical, and anthropometric measures. Naval Air Station Pensacola, FL: U.S. Naval Aerospace Medical Institute.

The Pensacola Thousand Aviator Study began in 1940 with the examinations of 1056 student aviators and flight instructors on a variety of physiological, psychological, and socio-economic parameters. Follow-up examinations on the group were conducted in 1951, 1957, and 963. During the 1963 follow-up, smoking history information on 675 subjects was obtained by questionnaire and confirmed by interview, together with concurrent data from clinical examinations, laboratory tests, anthropometry, and personal history variables. Two smoking variables were created, Cigarette Amount (CA) and Cigarette Years (CY), each on a scale of 1 to 5 points. From the concurrent data, 62 variables were selected for relevance and general interest

to be examined in relation to smoking. Twenty-four of the 62 variables had significant correlations ($p < .05$) with CA, and 16 showed significant relationships to CY. Findings are related briefly to previous research and problems of cause-effect isolation are mentioned. It is concluded that results in general support of previous findings on smoker-nonsmoker differences.

Lane, N. E., & Peterson, F. E. (1966). College major differences in naval flight officer training performance. Pensacola, FL: U.S. Naval Aerospace Medical Institute.

Lansberg, M. P. (1973). Predictability of motion sickness in the selection of pilots. Paris: Advisory Group for Aerospace Research and Development.

Lardent, C. L. (1991). Pilots who crash: Personality constructs underlying accident prone behavior of fighter pilots. *Multivariate Experimental Clinical Research, 10*(1), 1-25.

This article examines whether measures of certain personality constructs can predict pilot involvement in accidents. The author makes the assumption that there is not a unitary set of noncognitive measures that make one more likely to be involved in accidents. Rather, there may be some personal characteristics that, depending on the circumstances, predispose one person more than another to engage in behaviors that increase the probability that he or she will be involved in an accident. Specifically, the author attempts to answer the question of whether or not there are personality, motivational and/or other psychological variables associated with behavioral responses that, under various circumstances, are more or less likely to result in aircrew accidents. An extreme groups design was utilized including 89 F-4 fighter aircraft pilots who were involved in at least one class A mishap and 89 F-4 pilots who were considered to be accident-free (control group). Form A of the 16 PF was used to assess personality. This instrument measures 16 source or primary factors and eight secondary factors (in addition to including several validity scales). The impact of life changes on temporary accident proneness was also measured using the Holmes-Rahe Social Readjustment Rating Questionnaire (SRRQ). Accident involvement was a dichotomous variable, either "crash" or "safe." Relationships between the variables were examined using set correlations. None of the eight 16 PF secondary factors or the SRRQ scales yielded significant relationships with the crash criterion. For the 16 PF primary factors, pilots who crashed scored significantly higher than those who did not crash on conscientious and self-sufficient. They also scored significantly lower on trusting, naive and relaxed/tranquil. The multiple correlation between the predictor set (i.e., the significant 16 PF scales) and "crashing" was .52. The results were not cross-validated, but the estimated cross validation coefficient was .23. The author interprets the results as supporting the need to conduct "limited domain" research because past research has convincingly debunked the notion of a "grand theory" of accident proneness.

Larsen, W. E., Randle, R. J., & Popish, L. N. (Eds.). (1994). *Vertical Flight Training: An Overview of Training and Flight Simulator Technology With Emphasis on Rotary-Wing Requirements*: National Aeronautics and Space Administration NASA-RP-1373.

Laurence, J. H., & Hoffman, R. G. (1993). A description and evaluation of selection and classification models. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

This report is part of an overall project to identify an evaluate alternative models for

selecting and classifying soldiers into military occupational specialties. Tasks 1 and 2 of the project are documented in this report. More specifically, this document contains descriptions of the selection and job assignment processes in the Army, Navy, Marine Corps, and Air Force in terms of their intended design and operational reality. Subsequent to the description of current military selection and classification systems, alternative models are presented and evaluated along numerous qualitative dimensions.

Ledvinka, J. (1979). The statistical definition of fairness in the federal selection guidelines and its implications for minority employment. *Personnel Psychology, 32*, 551-562.

Lee, W. T. (1922). *The Face of the Earth as Seen From the Air*. New York: American Geographical Society.

Legree, P. J., Pifer, M. E., & Grafton, F. C. (1997). ASVAB Correlations Are Lower for Higher Aptitude Groups (pp. 20). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Leiman, J. M., & Friedman, G. (1952). Validation of Aircrew Classification Battery against advanced flying training - single engine jet criterion. Lackland Air Force Base, TX: USAF Human Resources Research Center.

Leino, T. K., Leppaluoto, J., Ruokonen, A., & Kuronen, P. (1999). Neuroendocrine responses and psychomotor test results in subjects participating in military pilot selection. *Aviation, Space, and Environmental Medicine, 70*(6), 571-576.

LeMaster, W. D., & Gray, T. H. (1974). Ground training devices in job sample approach to UPT selection and screening. Williams Air Force Base, AZ: Air Force Human Resources Laboratory.

Lepley, W. M. (Ed.). (1947). *Psychological research in the theaters of war. Report No. 17*. Washington, DC: U.S. Government Printing Office.

Leshowitz, B., Parkinson, S., & Waag, W. L. (1974). Visual and auditory information processing in flying skill acquisition. Williams Air Force Base, TX: Air Force Human Resources Laboratory.

Lessard, P. B. (1981). *A simulated aircraft landing test as a pilot selection test*. Paper presented at the 23rd Annual Military Testing Association Conference, Arlington, VA.

Pilot selection in the Canadian Armed Forces has been a continuing concern especially since attrition rates for trainees has been as high as fifty percent on a few courses. In the reported study, the utility of a custom-developed, microprocessor-driven aircraft landing test WT), was examined in terms of its added value to the current pilot selection battery. A CROMENCO II microcomputer was programmed to simulate the landing of a light aircraft where visual stimulation was presented on a CRT and the candidates used a ~~j~~oystick" and throttle to perform three landing tests. Several dependant measures were automatically recorded every 500 m sec. This ALT was a further development of earlier research conducted on another system. (Fowler,

1981). One hundred and fifty male candidates applying for military flying training were tested on the ALT as well as on the current test battery which consists of a psychomotor test in an aviation tester, pencil-and-paper tests which tape verbal and quantitative aptitudes and a memory test. The candidates also completed a measure of cognitive style, the Group Embedded Figures .Test, and selected scales from Jackson‘ s Personality Research Form. It was found that performance on the ALT was independent of performance on the current test battery as well as performance on the Group Embedded Figures Test and the selected scales from Jackson‘s Personality Research Form. Future research into the use of the ALT as a selection device will take place once trainees have completed the primary flying training course.

Lester, L. F., & Bombaci, D. H. (1984). The relationship between personality and irrational judgment in civil pilots. *Human Factors, 26*(5), 565-572.

The author discusses the increasing dependability and reliability of aircrafts and how this has made the role of the human operator much more critical. One effort to identify individual attributes that are important to aviation safety has been the delineation of five hazardous thought patterns (HTPs): anti-authority, impulsivity, invulnerability, macho and resignation. These HTPs are thought to have the status of constructs and are seen as mediating the link between basic psychological processes and irrational pilot judgment. Even though there is basically no validity research on these HTPs, they are a core element of the judgment training currently being conducted by several U.S. and Canadian airlines. The purpose of this study was to examine the construct validity of these HTPs using the 16 PF and Rotter's Locus of Control scale. Thirty-five male pilots participated (4 held commercial ratings and 3 1 had private licenses). Subjects completed three scales from the 16 PF (impulsivity, superego strength and integration self-concept control) and the Rotter Locus of Control scale. They also completed a self-assessment inventory designed to measure the five HTPs. When completing this inventory, subjects represented with 10 flight scenarios that describe errors in pilot judgment and asked to rank (from most probable to least probable) the reasons why they might have made the error. Results showed that fourteen of the subjects did not have a predominant HTP, but the percentage of pilots showing a single dominant HTP was similar to that found in later studies (e.g., Lester & Connolly, 1987). Of the remaining subjects, 43 percent primarily exhibited the invulnerability HTP, impulsivity was dominant in 20 percent and macho was dominant in 14 percent. The remaining HTPs were predominant in only a few subjects. An analysis of variance (ANOVA) revealed a significant relationship between the three HTPs and the integration self-concept control scale and Rotter's locus of control scale. Pilots with the invulnerable HTP scored significantly lower on the integration scale and pilots with the macho HTP scored significantly higher on the integration scale. Also, pilots with the dominant macho HTP were significantly more internally controlled than either the invulnerable or impulsive pilots. The authors conclude that this study provides some support for the construct validity of the HTPs, but notes that their sample was extremely small.

Lester, L. F., & Connolly, T. J. (1987). *The measurement of hazardous thought patterns and their relationship to pilot personality*. Paper presented at the 4th International Symposium on Aviation Psychology, Columbus, OH.

The authors state that errors in pilot decision-making (PDM) can be accounted for by five hazardous thought patterns (HTPs): anti-authority, impulsivity, invulnerability, macho and resignation. However, the evidence for these HTPs is largely anecdotal and their exact nature is

not very clear. For example, some researchers consider them to be attitudes, while others consider them to be personality variables. This study was conducted with five purposes: (1) establish base rates for the different HTPs; (2) examine the relationships among the HTPs; (3) determine how the HTPs are related to pilot personality; (4) determine whether the HTPs are related to involvement in aviation accidents and incidents; and (5) examine the utility of two forms of the Pilot Decision Making Questionnaire (PDMQ). One hundred fifty-two males in their late teens or early twenties (all pilots) were used as subjects in this study. They had an average of 190 flight hours. Subjects completed the Rotter Locus of Control Scale, four scales from the 16 PF (Emotional Stability, Surgency, Conscientiousness and Integration) and two forms of the PDMQ. In the PDMQ Form A, subjects are presented with scenarios and asked to indicate whether the pilot's behavior was "very much like me" or "not at all like me." This is designed to be a measure a subject's overall propensity toward irrational judgment. The PDMQ Form P describes irrational decisions and presents the subjects with reasons (each representing a HTP) for why that pilot behaved as he or she did. Subjects are asked to rate how likely it was that each of the reasons would have caused the pilot to behave in that manner. This was designed to measure the strength of each of the HTPs. These data were analyzed and subjects were classified according to their predominant HTP (39%-Invulnerable, 24%-Impulsive, 19%-Macho, very few-Resignation, 0% Anti-Authority). HTP intercorrelations ranged from .21 to .53 and all were positive. Subjects who displayed the Macho HTP were significantly more internally controlled than subjects who displayed the Invulnerable or Impulsive HTPs. They were also more Conscientious than those classified as Invulnerable. No other significant differences among the groups were found. Subjects were separated into groups with "better" and "poorer" judgment on the basis of their scores on the PDMQ Form A. Pilots with better judgment were more internally controlled and were better integrated than those with poorer judgment. No relationships were found between scores-on the PDMQ Form A and involvement in aviation accidents/incidents.

LeTourneau, D. J., & Merren, M. D. (1973). Experience with electroencephalography in student naval aviation personnel, 1961-1971. *Aerospace Medicine, 44*, 1302-1304.

Levine, A. S. (1957). A well-diversified portfolio of military selection research. *Personnel Psychology, 10*, 433-438.

Levine, A. S., & Tupes, E. C. (1952). Postwar Research in Pilot Selection and Classification. *Journal of Applied Psychology, 36*, 157-160.

The extensive World War II research on the Aviation Cadet Classification Battery has been reported in the Army Air Forces Psychology Program Research Reports (2, 3, 4). This article proposes to summarize major findings of postwar research in pilot selection and classification in the United States Air Force (1, 5).

Levine, J. B., Lee, J. O., Ryman, D. H., & Rahe, R. H. (1976). Attitudes and accidents aboard an aircraft carrier. *Aviation, Space, and Environmental Medicine, 47*, 82-85.

This article examines the relationships between behavioral attitudes and accidents for aviators and enlisted air wing support personnel aboard an aircraft carrier. One hundred fifty-six aviators and 879 support personnel participated in this study. These subjects completed a 22-item attitude questionnaire which asked them to rate the extent to which they agreed or disagreed with

each statement. The questionnaire was factor analyzed (varimax rotation) and items loading most highly on each factor were summed to form six scales: logic, adventurousness, discipline, concern with self and brashness. The accident criterion was the number of personal injuries (or deaths) which were sufficiently severe to require a visit to sick call. Results showed that the Adventurousness scale was significantly correlated with personal injuries among the enlisted air crew personnel ($r = .12$, $p < .01$) and with aircraft accidents among aviators ($r = .25$, $p < .01$). None of the other five factor-analytically derived scales were correlated with accidents for either sample.

Levine, J. G. (1936). What makes an aviator? *Medical Record. New York, 143*, 463-464.

Levy, R. A., Tolson, D. B., & Carlson, E. H. (1979). Student pilots referred to the neuropsychiatry branch, USAFSAM 1968-1969: Implications for selection. *Aviation, Space, and Environmental Medicine, 50*, 1173-1175.

Lewis, J. E. (Ed.). (2003). *The Mammoth Book of Eyewitness World War I*. New York: Carroll & Graf.

Lewis, R. J. (2000). *An Introduction to Classification and Regression Tree (CART)Analysis*. Paper presented at the Annual Meeting of the Society for Academic Emergency Medicine, San Francisco, CA.

A common goal of many clinical research studies is the development of a reliable clinical decision rule, which can be used to classify new patients into clinically-important categories. Examples of such clinical decision rules include triage rules, whether used in the out-of-hospital setting or in the emergency department, and rules used to classify patients into various risk categories so that appropriate decisions can be made regarding treatment or hospitalization. Traditional statistical methods are cumbersome to use, or of limited utility, in addressing these types of classification problems. There are a number of reasons for these difficulties. First, there are generally many possible ―predictor" variables which makes the task of variable selection difficult. Traditional statistical methods are poorly suited for this sort of multiple comparison. Second, the predictor variables are rarely nicely distributed. Many clinical variables are not normally distributed and different groups of patients may have markedly different degrees of variation or variance. Third, complex interactions or patterns may exist in the data. For example, the value of one variable (e.g., age) may substantially affect the importance of another variable (e.g., weight). These types of interactions are generally difficult to model, and virtually impossible to model when the number of interactions and variables becomes substantial. Fourth, the results of traditional methods may be difficult to use. For example, a multivariate logistic regression model yields a probability of disease, which can be calculated using the regression coefficients and the characteristics of the patient, yet such models are rarely utilized in clinical practice. Clinicians generally do not think in terms of probability but, rather in terms of categories, such as ―low risk" versus ―high risk."

Lidderdale, I. G., & Elshaw, C. C. (1981). *Flying selection in the Royal Air Force*. Paper presented at the 23rd Annual Military Testing Association Conference, Arlington, VA.

The paper describes the results of a study designed to evaluate the utility of a flight selection test for Royal Air Force pilot candidates. 53 pilot applicants acted as subjects in a

controlled trial, based on a 14 hour light aircraft course. Tests were marked in the air at 9 and 14 hours by independent examiners. When all of the students had completed the RAF Basic Flying Training course one year later, their tests results were compared with raining outcomes. The results indicated a very high relationship between flying test marks and probability of success in later training. The marks awarded by the examiners were more predictive than the assessments of the flying instructors. Based on the results of the trial, the RAF established a Flying Selection Squadron and the paper presents some data from follow-up studies which were carried out as a validation of the selection procedure.

Lievens, F., Harris, M. M., Van Keer, E., & Bisqueret, C. (2003). Predicting cross-cultural training performance: The validity of personality, cognitive ability, and dimensions measured by an assessment center and a behavior description interview. *Journal of Applied Psychology, 88*(3), 476-489.

This study examined the validity of a broad set of predictors for selecting European managers for across-cultural training program in Japan. The selection procedure assessed cognitive ability, personality, and dimensions measured by assessment center exercises and a behavior description interview. Results show that the factor Openness was significantly related to cross-cultural training performance, whereas cognitive ability was significantly correlated with language acquisition. The dimensions of adaptability, teamwork, and communication as measured by a group discussion exercise provided incremental variance in both criteria, beyond cognitive ability and personality. In general, these results are consistent with the literature on domestic selection, although there are some important differences.

Liljencrantz, E. (1942). Problems in the selection of aviators. *Journal of Aviation Medicine, 13*, 107-120.

Liu, H. C.-E. (1922). *Non-Verbal Intelligence Tests for Use in China*. New York: Teachers College, Columbia University.

Lockman, R. (1953). The predictive use of linear discriminant function in Naval aviation cadet selection. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Lockman, R. (1953). Readability of NAVCAD selection tests. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Lockman, R. (1954). An evaluation of Naval aviation cadet selection measures using multivariate discriminatory statistical techniques. *Dissertation Abstracts, 14*, 1262-1263.

Lockman, R. (1954). Multivariate statistical analyses of Naval aviation cadet selection measures. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Lockwood, R. E. (1983). FAST scores as predictors of accident involvement. Fort Rucker, AL: ANACAPA Sciences, Inc.

Lockwood, R. E., & Cohen, R. J. (1982). Research Plan: Development of a 1984-1985 version of the Army Flight Aptitude Selection Test. Ft Rucker, AL: Anacapa Sciences, Inc.

Lockwood, R. E., & Shipley, B. D. (1984). Evaluation of the Revised Flight Aptitude Selection Test. Ft Rucker, AL: U.S. Army Research Institute Field Unit.

Loening, G. C. (1911). *Monoplanes and Biplanes: Their Design, Construction and Operation*. New York: Munn and Company.

Lofaro, R. J., & Intano, G. P. (1989). *Exploratory research and development: The U.S. Army aviator candidate classification algorithm*. Paper presented at the 5th International Symposium of Aviation Psychology, Columbus, OH.

Long. (2006). Summer in Stockholm. *Civil Aviation Training,* 26-27.

Long, C. (2007). Loganair The masters of highland flying. *Civil Aviation Training,* 12-13.

Long, G. E., & Varney, N. C. (1975). Automated pilot aptitude measurement system. Lackland AFB, TX: Air Force Human Resources Laboratory.

Lowe, A. R., & Hayward, B. J. (Eds.). (2000). *Aviation Resource Management* (Vol. 2). Aldershot: Ashgate.

Lowe, T. S. C. (1911). The Balloons Wioth the Army of the Potomac. In Miller (Ed.), *The Civil War In Ten Volumes* (Vol. 8, pp. 370-392). New York.

Lubner, M., Hellman, F., Struening, E., & Hwoschinsky, P. (1999). *Personality factors as risks for aviation accidents or incidents among U.S. pilots*. Paper presented at the 10th International Symposium on Aviation Psychology, Columbus, OH.

Lubner, M., Hunter, D., & Struening, E. (2001). *Reliability and Validity of Decision Making Styles Self-Test*. Paper presented at the 11th International Symposium on Aviation Psychology, Columbus, OH.

This paper continues to develop a measure of decision making styles among U.S. pilots. Previous studies have examined this measure with some success (Lubner et al., 1999; 1997). The measure was designed to be incorporated into a set of Advanced Aeronautical Decision Making (AADM) training programs. These programs are based on techniques used by experts (Adams, et al., 1995). Having a brief, reliable, valid and adaptable test that could be self-administered should improve the acceptance, implementation and evaluation features of the AADM programs. Such a measure would also be useful for research purposes, and perhaps, for pilot selection.

Luk'yanova, N. F. (1979). Personality characteristics of pilot-cadets with different marks in flight disciplines. Charlottesville, VA: U.S. Army Foreign Science Technology Center.

Lyall, B., Harron, G., Acuna, A., Eis, K., & Johnson, D. (2007). *Integrating unmanned aircraft into the national airspace*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

Currently there is a lot of interest in integrating unmanned aircraft systems (UASs) into

the national airspace system (NAS). Well-established processes are currently in place to certify all aspects of the design, operation, training, and maintenance of the aircraft now in the NAS. The FAA is drawing on these experiences and processes to develop certification criteria for UASs as there are requests for them to enter the NAS. It is important to identify the differences between manned aircraft and unmanned aircraft systems and how those differences will impact operations in the NAS. As these differences are addressed, all users that will impacted in the system should be considered, as well as the infrastructure of the certification processes and regulatory requirements. Operations in the National Airspace System will inevitably change with the introduction of UASs. As an industry, we must utilize established processes and current tools to work together to successfully adapt to these emerging technologies.

Lynch, W. E. (1991). *A meta-analysis of pilot selection tests: Success and performance in pilot training.* MA, Air Force Institute of Technology, Wright-Patterson AFB, OH.

Lyon, V. W. (1951). Pilot candidate selection research project. *Journal of Aviation Medicine, 22*, 152-155.

Maag, C. H., & Bair, J. (1956). Religious values as differentiating characteristics of Naval aviation cadets. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Maag, C. H., & Bair, J. T. (1952). Expressed reasons for entering the Naval aviation training program. (Attrition Report #4). Pensacola, FL: Naval Aerospace Medical Institute.

Maciejczyk, J., Kossowski, J., & Kuzak, W. (1995). *Evaluating correlation between scores yielded by pilot candidates on flight simulator and combat planes during elementary air training*. Paper presented at the 37th Annual International Military Testing Association Conference, Toronto, ON, Canada.

In a present-day aviation, either civil or military, the flight simulators are more intensively used. The flight simulator allows for training of motor, perception and decision-making activities under the conditions close to natural. The favorable relation of costs and security of training follow-up with reference to the same activities tested on a real flight is the main cause of a wider use of the flight simulators (Svoboda, Heron, Weinberg, 1993). According to Orlansky & Chatelier (1983), the use of flight simulators enables to save almost 50 percent on training time as compared to the same conditions in which no simulators were used. Appropriate calculations show that training costs with the use of simulators are only 80% of those with the use of the planes. Operation and service costs pertaining to the flight simulators depending upon the type of training tasks pay off gradually within the time interval from 7 months to 2 years.

Maciejczyk, J., Kuzak, W., & Franciszek, S. (1995). *Prognostic evaluation of selected psychological methods referring to the investigation results of candidates for military aviation yielded on the flight simulator*. Paper presented at the 37th Annual International Military Testing Association Conference, Toronto, ON, Canada.

The aim of the paper was to determine a degree of relations between the real results obtained with flight simulator by candidates examined for military aviation and their psychological results. The stochastic relation in the form of linear function between studied variables was particularly investigated. The linear analysis of regression was used for that purpose. The authors indicated a significant relation between such psychological variables as:

temperamental traits, eye-movement coordination, relation assessment: velocity-distance, mental skills and reaction time with choice and simulated flight results. Low percent assessment errors (approximation) proves not only of .the power, but also of a high and significantly higher than zero coefficient of multiple correlation.

Mackaman, S. L., Bittner, A. C., Harbeson, M. M., Kennedy, R. S., & Stone, D. A. (1982). Performance Evaluation Tests for Environmental Research (PETER): Wonderlic Personnel Test. *Psychological Reports, 51*, 635-644.

MacKinnon, D. W., Crutchfield, R. S., Barron, F., Block, J., Gough, H. G., & Harris, R. E. (1958). An assessment study of Air Force officers: Part I: Design of the study and description of the variables. Lackland Air Force Base, TX: Personnel Laboratory.

Madhaven, P., and Lacson, F.C. (2006). Psychological factors affecting pilots' decisions to navigate in deteriorating weather. *North American Journal of Psychology, 8*(1), 47-62.

Poor pilot decision-making in deteriorating weather is the leading cause of a significant percentage of fatalities arising from aviation accidents in the last two decades. Research has identified psychological factors underlying pilot decision strategies as the primary reasons for faulty decision making during inclement weather conditions. In the present review, the authors attempt to evaluate existing experimental data on the cognitive and affective processes that govern pilot decision making in changing weather conditions, with specific emphasis on instances of VFR (visual flight rules) flight into IMC (instrument meteorological conditions). We present a consolidated model of pilot decision processes and at each stage in the decision tree we discuss the possible intrinsic and extrinsic factors that might affect the efficacy of cockpit decisions. Based on this model, we examine interventions aimed at reducing the incidence of sub-optimal pilot decision making under poor weather conditions. Suggestions for improving the quality of aeronautical decision making through the use of technology and training are provided.

Mahoney, H. (1957). An analysis of current personnel selection for navigator training in the USAF. Maxwell Air Force Base, AL: Air University, Air War College.

Majesty, M. S. (1973). *Centralized selection system for Air Force pilots*. Paper presented at the 15th Annual Military Testing Association Conference, San Antonio, TX.

Makgati, C. K. M. (2000). *The transformed South African Defense Force: Challenges for pilot selection*. Paper presented at the 42nd Annual International Military Testing Association Conference, Edinburgh, UK.

With the advent of democracy in South Africa, the personnel practices of its National Defence Force had to change. Prior to the 1994 national elections, the practice of appointing only white candidate pilot was never challenged. An increasing pressure has however subsequently been brought to bear on the organisation to address the issue of representavity amongst pilots. Integration of the pre-election armed forces resulted in a degree of representavity amongst junior and support ranks. However, the senior and specialised ranks remain relatively unrepresentative, consisting mainly of white males. The process of recruiting suitable black candidates for technical professions is made difficult by the fact that these individuals are in high demand by the private sector and depressed by the relatively poor remuneration packages within the

government departments. One area in which representavity has became a politically sensitive issue is that of black pilots. This has resulted in a degree of suspicion and enmity towards the current pilot selection procedure. The Military Psychology Institute (MPI) is currently coming under pressure to change the manner in which pilots are being selected for the SANDF. The author of this paper will thus present a critical review of the black pilot(s) recruitment and filtering process for such appointments. In addition, discuss the management of pilot selection as a professionally and legally defensible practice addressing the core areas of who sits in the selection panel, tests batteries used for this and finally, a brief look into how the training is being executed.

Manganaris, A. G., & Schmitz, E. J. (1984). Projecting attrition by military occupational specialty. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

This research analyses the attrition rates of various enlisted personnel groups within different Army job assignments. Three regression equations are developed in order to project the attrition rate of eight demographic groups to 76 Military Occupational Specialties (MOS). Education, sex, AFQT, along with MOS assignment are the independent variables. The rates generated by these equations show where important tradeoffs exist with respect to personnel allocation and the expected rate of attrition.

Mangos, P. M., Arnold, R. D., Mead, A., Merket, D., Littrell, L., Credo, K., . . . Kessler, S. (2005). Technical Report: Analysis of Work of Naval Aviation Training Pipelines. Orlando, FL: Naval Air Warfare Center Training Systems Division.

Manning, G. W. (1954). Electrocardiography in the selection of Royal Canadian Air Force aircrew. *Circulation, 10*(3), 401-412.

Manning, G. W., & Gibbon, G. M. (1956). Electrocardiography in the selection of aircrew members; an opinion survey in the Royal Canadian Air Force. *Journal of Aviation Medicine, 27*(3), 221-225.

Manning, R. V., & Yellowlees, L. A. (1949). RCAF aircrew selection methods. *Journal of Aviation Medicine, 20*, 58-61.

Manning, S. D., Rash, C. E., LeDuc, P. A., Noback, R. K., & McKeon, J. (2004). The role of human causal factors in U.S. Army unmanned aerial vehicle accidents. Ft Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Mansfield, C. B. (1877). *Aerial Navigation*. London: Macmillan and Co.

Marco, R. A., Bull, R. F., Vidmar, R. L., & Shipley, B. D. (1979). Rotary wing proficiency-based aviator selection System (PASS). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The Proficiency-Based Aviator Selection System (PASS) is the result of an operational feasibility program developed to determine whether a learning sample approach could be used to select candidates for rotary wing aviator training. PASS was based on the Automated Pilot

Aptitude Measurement System (APAMS), a five-hour learning sample of fixed wing piloting tasks, developed for the Air Force Pilot Selection Program. PASS utilizes a UH-1 Flight Simulator (UH-IFS) with a five-degree-of-freedom motion bas to present the syllabus and test materials. The APAMS syllabus was extensively modified to conform to rotary wing flight operations, and the UH-IFS software was reconfigured and formatted to meet the PASS requirements for training and performance measurement. Four voice synthesizers (VOTRAX) were interfaced to the UH-IFS to provide vocal feedback. The operational capability of the PASS was demonstrated in a test with 11 experienced rotary wing pilots and 11 candidates for rotary wing training. The primary audience for this report will be operational personnel in training selection and simulation, particularly for rotary wing aircraft.

Marco, R. A., Miller, J. T., Eschenbrenner, A. J., & Dohme, J. A. (1980). Aviator job/task descriptions.

Marion, F. (1874). *Wonderful Balloon Ascents: or The Conquest of the Skies*. New York: Scribner, Armstrong and Co.

Marsh, A. K. (1999, October). Why pilots flunk airline interviews. *AOPA Pilot, 42,* 137-143.

Marsh, R. W. (1996). Description of the neuropsychiatry branch with an annotated bibliography (January 1995 - June 1996). Brooks Air Force Base, TX: Armstrong Laboratory.

Marshburn, T. H. (2007). *Why they fly: An expectancy-based analysis of the factors that motivate commissioned Army aviators to gain flying experience.* Master of Arts, U.S. Army Command and General Staff College, Fort Leavenworth, KS.

Marshburn, T. H., & Rollin, S. A. (2005). The Motivational Orientation of Army Aviators. *Military Psychology, 17*(2), 69-87.

Martin, L. L. (1999, June). Testing for a good fit. *Business & Commercial Aviation,* 88-93.

Martin, S. S. (1982). Aviation warrant officer retention: A summary of past, present and projected research by the Army Research Institute. Ft. Rucker, AL: Anacapa Sciences, Inc.

Martinussen, M. (1996). Psychological Measures As Predictors of Pilot Performance: A Meta-Analysis. *International Journal of Aviation Psychology, 6*(1), 1-20.

Examines the validity evidence for psychological measures used in pilot selection and detection of the relationship between predictors and pilot performance. Inclusions of the meta-analysis; Identification of the predictors of pilot performance; Results of the personality, intelligence and academic tests. Examines the validity evidence for psychological measures used in pilot selection and detection of the relationship between predictors and pilot performance. Inclusions of the meta-analysis; Identification of the predictors of pilot performance; Results of the personality, intelligence and academic tests.

Martinussen, M. (2005). Seleksjon av flygere og flygeledere. *Tidsskrift for Norsk*

Psykologforening, 42(4), 291-299.

Martinussen, M., & Hunter, D. R. (2010). *Aviation psychology and human factors*. Boca Raton: CRC Press/Taylor & Francis.

Martinussen, M., & Torjussen, T. (1993). *Does DMT (Defense Mechanism Test) only predict pilot performance in Scandinavia?* Paper presented at the 7th International Symposium on Aviation Psychology, Columbus, OH.

Martinussen, M., & Torjussen, T. (1998). Pilot Selection in the Norwegian Air Force: A Validation and Meta-Analysis of the Test Battery. *International Journal of Aviation Psychology, 8*(1), 33-45.

Examines the test battery used for pilot selection of the Air Force in Norway. Evaluation of the cognitive and psychomotor abilities; Decline of predictive validity on personality and intelligence test; Comparison of the test results. Examines the test battery used for pilot selection of the Air Force in Norway. Evaluation of the cognitive and psychomotor abilities; Decline of predictive validity on personality and intelligence test; Comparison of the test results.

Martinussen, M., & Torjussen, T. M. (2004). Initial validation of a computer-based assessment battery for pilot selection in the Norwegian Air Force. *Human Factors and Aerospace Safety, 4*(3), 233-243.

Martoccia, C. T., & Kelley, P. H. (1957). Some differences among Naval aviation cadets who attrited during presolo stage, later basic flight training, and advanced air flight training. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Martoccia, C. T., & Nelson, W. H. (1956). Comparison of instructor grade and instructor expressed opinion as predictors of student success in Naval air flight training. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Maschke, P. (2004). The acceptance of ab initio pilot selection methods. *Human Factors and Aerospace Safety, 4*(3), 225-232.

Mashburn, N. C. (1934). The Complex Coordinator as a performance test in the selection of military flying personnel. *Aviation Medicine, 5*, 145-154.

Mashburn, N. C. (1934). Mashburn automatic serial action apparatus for detecting flying aptitude. *Journal of Aviation Medicine, 5*, 155-160.

Mashburn, N. C. (1939). The selection of the trainee for military aviation. *Military Surgeon, 84*, 428-441.

Mashburn, N. C., & Marshall, F. A. (1942). Aviation medical standards, British RAF vs U.S. Army Air Corps. *Journal of Aviation Medicine, 13*, 62-71.

Mason, K. T. (1995). U.S. Army Aviation Epidemiology Data Register: Descriptive Analysis of

Medical Disqualifications Among Female Army Aviator Training Applicants. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Mason, K. T. (1996). U.S. Army Aviation Epidemiology Data Register: Rates of Exceptions to Policy Granted to Medically Disqualified U.S. Army Aviator Students from FY 1986 to FY 1990. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Matessa, M. (2004). *A Review of Taxonomies, Tests, and Task Mappings for Cognitive Abilities*. NASA Ames Research Center.

A goal set in the 2004 Cognition in Space Workshop was to "review the literature on predictors of individual performance in real-world tasks and develop a set of tests to be used during all NASA-funded research simulating space missions (e.g., bed-rest studies)." This literature review examines skill taxonomies, skill measures, and skill/task mappings.

Mathews, J., & Lupfer, B. (1957). Development of tests to measure nonintellectual aspects of officer aptitude. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Mathews, J. J. (1977). Racial equity in selection in Air Force officer training school and undergraduate flight training. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Maurer, M. (Ed.). (1978). *The U.S. Air service in World War I* (Vol. I). Washington, DC: Office of Air Force History.

Maurer, M. (Ed.). (1978). *The U.S. air service in World War I* (Vol. II). Washington, DC: Office of Air Force History.

Maxim, H. S. (1908). *Artificial and Natural Flight*. New York: Whittaker & Co.

Mayer, K. S. (1991). Bibliography of scientific publications 1978-1990. Pensacola NAS, FL: Naval Aerospace Medical Research Laboratory.

McAnulty, D. M. (1988). *Pre-operational validation of new Flight Aptitude Selection Tests*. Paper presented at the 30th Annul Military Testing Association Conference, Arlington, VA.

McAnulty, D. M., & Jones, D. H. (1984). *An evaluation of aviator training ability requirements scale ratings.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting.

The Ability Requirements Scales developed by Fleishman and his associates have been widely used as a job analysis technique. However, the ability ratings obtained with this technique may be confounded by rater bias effects. Fifteen instrument-phase instructor pilots rated the extent to which 32 basic abilities were required to perform 16 helicopter training tasks. Psychometric analyses showed significant differences in rater distributions. The method of successive intervals was used to transform the ratings to a common, equal-interval scale.

Analyses of the transformed ratings indicate that significant task-ability discriminations were made that produced a logical, interpretable pattern of ability and task interrelationships.

McAnulty, D. M., & Jones, D. H. (1984). *An examination of ability requirements for various rotary wing missions.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting.

The increasing specialization of rotary wing missions and aircraft has precipitated a reanalysis of traditional strategies for assigning student aviators to one of four rotary wing missions: cargo, utility, aeroscout, or attack. Although previous research has suggested that certain abilities are appropriate for inclusion in a classification algorithm, there are no data to indicate that there are differences in the ability requirements (types or levels) for the four missions. This paper describes the results of several analyses designed to compare the ability requirements of the four missions. Ability rating data, obtained from subject matter experts for each mission, were transformed using the Method of Successive Intervals (MSI) to remove systematic biases identified in the raters' distributions. Analyses of the transformed data indicate that there are no differences in the types or levels of abilities required to perform the most demanding tasks for each mission.

McAnulty, M. D., & Shipley, B. D. (1984). Use of RFAST to select enlisted aerial observers. Fort Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences.

McCarley, J. S., & Wickens, C. D. (2005). Human Factors Implications of UAVs in the National Airspace. Chicago: University of Illinois.

Unmanned aerial vehicles (UAVs) are quickly becoming a part of the national airspace system (NAS) as they transition from primarily military and hobbyist applications to mainstream flight applications such as security monitoring, satellite transport, and cargo hauling. Before the full potential of UAV flight in the NAS can be realized, however, FAA standards and regulations for UAV operations must be established. Given the experience of the U.S. military that mishap rates for UAVs are several times higher than for manned aircraft (Williams, 2004)—over thirty times higher, in some cases (Department of Defense, 2001)—the importance of carefully designed standards and regulations is clear. Issues related to human factors are likely to be of particular concern in establishing guidelines for UAV flight. As noted by Gawron (1998), UAV flight presents human factors challenges different from and in some ways greater than those of manned flight. These arise primarily from the fact that operator and aircraft are not co-located. As discussed in more detail below, the separation of operator and vehicle imposes a number of barriers to optimum human performance, including loss of sensory cues valuable for flight control, delays in control and communications loops, and difficulty in scanning the visual environment surrounding the vehicle. Unmanned flight also allows the possibility that a single operator might control multiple vehicles simultaneously, a task likely to impose unique and heavy workload demands. The goal of the current work was to examine the existing research literature on the human factors of unmanned flight, and to delineate issues for future research to address. The topics discussed below are divided into the categories Automation; Perceptual and Cognitive Aspects of Pilot Interface; Air Traffic Management Procedures; and Crew Qualifications. As will be clear, however, the issues covered within the various categories are highly interrelated. Answers to questions about crew complement, for example, will be contingent on the nature and reliability of automation provided to support UAV operators.

Likewise, decisions about interface design will depend on the extent to which flight control is automated, with manual flight mode demanding traditional stick-and-rudder controls and automated flight mode allowing for point-and-click menu-based control or other forms of non-traditional interface.

McCloy, T. M. (1979). *Measures of time-sharing skill and gender as predictors of flight simulator performance.* Ph.D., Air Force Institute of Technology, Wright-Patterson AFB. A two-part experiment was conducted to assess the hypothesized utility of various time-sharing measures as indicators of performance in the general aviation flight trainer. Equal numbers of males (28) and females (28) participated as subjects. Part one involved single and dual performance on a single-axis, compensatory tracker and a digit-cancellation, reaction time task. There were no significant gender differences on time-sharing measures. Part two indicated significantly better male performance on all simulator variables. Separate multiple regression equations were calculated for males and females, as well as overall equations including gender as a variable. Besides gender in the overall equations, measures of time sharing skill were the best predictors of simulator performance in all three types of equations. The regression equations based on gender differed in constituent predictor variables as well as weightings on similar variables. The results demonstrate the utility of time-sharing measures as predictors of complex-task performance. Additionally, they suggest the appropriateness of employing gender based predictor equations when establishing training or selection criteria for male and female complex-task operators.

McComas, H. C. (1922). *The aviator*. New York: E.P. Dutton & Company.

McCullough, P. J. (1917). *Spherical Ballooning: Some of the Requirements*. Saint Louis, MO: The Mangan Printing Company.

McDaniel, J. W. (1978). AMRL's pilot strength and endurance screening program. Wright Patterson Air Force Base, OH: Aerospace Medical Research Laboratory.

McDonnel Douglas Corporation. (1973). Development of equipment, syllabus, and simulator learning sample measurement for pilot screening.

McFarland, R. A. (1939). Bibliography on the selection, training, and physical fitness of aviation pilots. Boston: National Research Council, Committee on Selection and Training of Aircraft Pilots.

McFarland, R. A., & Franzen, R. (1944). The Pensacola study of naval aviators: Final summary report. Washington, DC: U.S. Department of Commerce.

McFarland, R. A., & Franzen, R. (1946). The Pensacola study of Naval aviators: Final summary report. Washington, DC: U.S. Department of Commerce.

McGehee, W. (1951). Survey of psychological problems and service in Naval aviation (NRC Committee on Aviation Psychology, Report. Washington, DC: NRC Committee on Aviation Psychology.

McGlohn, S., & King, R. (1995). Assessment of Psychological Factors in Aviators. Brooks AFB, TX: Armstrong Laboratory.

McGlohn, S. E. (1996). Psychological Aspects of Aviators' Success. Brooks AFB, TX: Armstrong Laboratory.

McGlohn, S. E., King, R. E., & Patterson, J. C. (1995). Outline of neuropsychiatry in Aviation Medicine II (C. S. D. Aerospace Medicine Directorate, Trans.). Brooks Air Force Base, TX: Armstrong Laboratory.

McGlohn, S. E., King, R. E., Retzlaff, P. D., Flynn, C. F., & Butler, J. W. (1996). Psychological Characteristics of United States Air Force Pilots. Brooks AFB, TX: Armstrong Laboratory.

McGrevy, D., & Valentine, L., D., Jr. (1974). Validation of two aircrew psychomotor tests (pp. 1-18). Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

McIntosh, V. M. (1958). The relationship of certain institution variables to the success of Air Force graduates in pilot training. Maxwell Air Force Base, AL: Headquarters Air Force Reserve Officer Training Corps.

McKenna, F. P., & Sharma, D. (1991). Predicting Performance Breakdown in Pilots Through Objective Measures of Stress Sensitivity: Final report. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

It is well known that stress can have an adverse effect on performance and that individual differences in responses to stress are varied. This research explores the potential of developing an objective measure of stress resistance and the possibility of developing a laboratory model of the effects of stress on performance. The paradigm developed reveals that (1) emotional stimuli disrupt performance, (2) the disruption is exacerbated by time pressure and task difficulty, (3) repetition of the emotional stimuli (habituation) eliminates the disruptive effect, (4) it is not the emotionality of the stimulus, but rather the threat component that is critical to the disruptive effect. These results parallel effects in everyday life and suggest that the paradigm shows great promise for developing a measure of stress resistance and a laboratory model of the effects of stress.

McMullen, R. L., & Eastman, R. F. (1975). *The current prediction validity of the flight aptitude selection tests*. Paper presented at the 17th Annual Military Testing Association Conference, Indianapolis, IN.

The Flight Aptitude Selection Tests (FAST), the Army's primary selection batteries for Warrant and Commissioned Officer aviators, were made operational in 1966 and have proven to be effective selection instruments. However, because of changes in initial flight training programs and the current population of aviation trainees, a revision of the FAST is underway. This study was conducted to determine how critical the need for revision is.

McReynolds, J. (1954). Administration of the Aviation-Cadet Officer-Candidate Qualifying Test

under operational versus part-timed conditions. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Score achieved by new airmen with a specific time limit for each section of the test are compared with those of new airmen taking the test under the operational administrative procedure which does not involve the use of specific time limits. The groups, equated on all variables of the Airman Classification Battery, took the test in 2 sessions; the actual testing time for both groups was the same. There were significant differences between groups for 6 of the 13 subjects with all differences in favor of the group with specific time limits.

Meignant, P. (1931). La selection des pilotes aviateurs. *Revue de Psychologie Appliquee de l'Est, 1*, 89-105.

Mekhail, A., Niemczyk, M., Ulrich, J., & Karp, M. (2010). Using the table reading test as an indicator for success in pilot training. *Collegiate Aviation Review, 28*(1), 101-114.

The Table Reading Test (TRT) assesses an individual‘s perceptual speed, or how rapidly one absorbs and processes visual search information. The focus of this study was to determine the validity of the TRT scores as a predictor of pilot training success. A total of 116 subjects enrolled in an aviation program at a major university in the southwest were tested between the Fall 2005 and Fall 2008 semesters, inclusive. Their TRT scores were tested for correlations to one of several flight/academic performance criterion. The results of the analyses found the TRT best predicts: Time to Solo ($r = -0.228$, $p < 0.024$), Time to Private ($r = -0.754$, $p < 0.001$), and GPA ($r = 0.283$, $p < 0.002$).

Melton, A. W. (1943). The selection of pilots by means of psychometric tests. *Journal of Aviation Medicine, 15*, 116-123.

Melton, A. W. (Ed.). (1947). *Apparatus tests. Report No. 4*. Washington, DC: U.S. Government Printing Office.

Melton, A. W. (1949). *Apparatus tests supplement*. Washington: Government Printing Office.

Melton, A. W. (1949). Pursuit Rotor with divided attention *Apparatus Tests*.

Melton, R. S. (1954). Studies in the evaluation of the personality characteristics of successful Navy aviators. *Journal of Aviation Medicine, 25*, 600-604; 650.

A new approach to selection research has been outlined, one that adapts the concepts of n-dimensional geometry to multivariate data. The MMPI was utilized as a measuring instrument and by means of a discriminant equation based on two clusters, 83 per cent of a sample of 935 NavCads were correctly categorized into pass and fail categories. It is anticipated that future selection batteries may be supplemented by personality measures.

Messer, M. G. (2006). Improving the UPT Student Follow-On Assignment Selection Process. Wight-Patterson Air Force Base, OH: Air Force Institute of Technology.

The Euro-NATO Joint Jet Pilot Training (ENJJPT) program at Sheppard AFB conducts Undergraduate Pilot Training (UPT) for 13 NATO nations with a focus on producing premier fighter pilots. As ENJJPT transitions to the new T-6 Texan II, the leadership is examining if the

current assignment model meets the needs of the US Air Force for the US students. To assign US students, the Senior National Representative uses the Merit Assignment Scoring System (MASS) to rank order students and assign aircraft based on preference and availability of assignments. MASS accounts for every activity in pilot training as well as a subjective input from the instructors as to the overall attitude and performance of the student. The score obtained from the MASS is categorical by assigning a weighting to a particular category of performance. Currently, there is no direct link between the skills needed to fly modern fighter aircraft and the MASS. Additionally, many of the skills learned in pilot training span multiple categories and it is possible for a deficiency to be buried in the MASS score. The goal of this research was to identify the core skills required to fly the various fighter aircraft through the use of a Combat Air Forces (CAF) wide survey instrument, interviews, and working group inputs. An assignment model was created with a focus on assigning students based on skill strengths. After the core skills were identified and related to UPT events, a value hierarchy was created and a model developed to identify the best aircraft fit for a student based on their performance as related to the skill sets. This paper frames the issues, outlines the methodology used to define the skill sets, and discusses the development of the model. Finally, recommendations are made on future changes to MASS, the UPT student assignment process, and the pilot training syllabus.

Meyer, R. P., Laveson, J. I., Weissman, N. S., & Eddowes, E. E. (1974). Behavioral taxonomy of undergraduate pilot training tasks and skills: Executive summary. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Meyer, R. P., Laveson, J. I., Weissman, N. S., & Eddowes, E. E. (1974). Behavioral taxonomy of undergraduate pilot training tasks and skills: Guidelines and examples for taxonomy applications in flying training research. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Meyer, R. P., Laveson, J. I., Weissman, N. S., & Eddowes, E. E. (1974). Behavioral taxonomy of undergraduate pilot training tasks and skills: Surface task analysis, taxonomy structure, classification rules and validation plan. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

The objective is to analyze and specify the fundamental flying abilities which comprise the training objectives of Undergraduate Pilot Training (UPT). The results of this analysis will be used as a foundation for structuring research on and recommendations for improvements in Air Force flying training programs. The Phase I effort both the surface analysis and the taxonomy structure. Examination of previous task and skill taxonomies failed to provide a useable basis for the present effort. The surface task analysis was developed on the basis of a breakdown of task elements according to the cue, mental action and motor action involved. The flying tasks analyzed were found to fall into three categories: fundamental transitions, composite transitions and continuous transactions. The surface task analysis was organized so the more complex flying maneuvers could be accommodated by a sequence of two or more of the three categories of task types identified. A cubic taxonomic structure was developed with cue, motor action and mental action dimensions. A set of classification rules were provided for locating any flying training task in a specific "pigeon hole" within the taxonomic structure. A procedure for evaluating the validity of the taxonomic system was established for use during Phase II of this program.

Meyer, R. P., Laveson, J. I., Weissman, N. S., & Eddowes, E. E. (1974). Behavioral taxonomy of undergraduate pilot training tasks and skills: Taxonomy refinement, validation and operations. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Michael, W. B. (1949). Factor analyses of tests and criteria: A comparative study of two AAF pilot populations. *Psychological Monographs, 63*(3), 1-55.

Miles, W. R. (1945). Psychological aspects of military aviation. In G. A. Baitsell (Ed.), *Science in progress; Fourth series*. New Haven: Yale University Press.

Miller, E. E. (1969). A taxonomy of response processes. Ft Knox, KY: Human Resources Research Organization.

Miller, F. T. (Ed.). (1911). *The Photographic History of the Civil War In Ten Volumes: Soldier Life; Secret Service* (Vol. 8). New York: The Review of Reviews Co.

Miller, J. T., Eschenbrenner, A. J., Marco, R. A., & Dohme, J. A. (1981). Mission track selection process for the Army Initial Entry Rotary Wing flight training program. Volume I. St Louis, MO: McDonnell Douglas Astronautics Co.

In June 1977, the U.S. Army Aviation Center (USAAVNC) instituted the 175/40 Initial Entry Rotary Wing (IERW) Flight Training Program. An integral feature of this program is a dual track in which students are selected for specialized tactical training employing the Aeroscout (OH-58) aircraft or for training in the Utility (UH-1) helicopter early in training. Success with the 175/40 program led to the concept of the Mission Track program in which students would receive specialized training in one of the four basic helicopter missions: Aeroscout, Attack, Utility, and Cargo. The intent is to replace the present IERW plenary rotary wing aviator with a "systems aviator" who will normally remain dedicated to a specialized aircraft system/mission for the balance of his military career. It is anticipated, that the systems aviator concept will result in more proficient aircrew performance in the tactical environment, thereby enhancing combat readiness in U.S. Army Forces Command units. The overall goal of this research effort was to initiate development of a Mission Track selection process. Four specific tasks had to be accomplished. First, the skills, aptitudes, and abilities (i.e., attributes) required for success in each mission had to be identified. Second, standardized tests and training course measures which assess those attributes had to be administered to IERW students. Third, preliminary selection algorithms had to be developed. Fourth, recommendations for a final Mission Track Selection Battery including suggestions for validation, had to be developed.

Miller, J. T., Eschenbrenner, A. J., Marco, R. A., & Dohme, J. A. (1981). Mission track selection process for the Army Initial Entry Rotary Wing flight training program. Volume II Appendices. St. Louis, MO: McDonnell Douglas Astronautics Co.

Miller, J. T., Marco, R. A., Eschenbrenner, A. J., & Dohme, J. A. (1979). Development of a mission track selection process for the Army Initial Entry Rotary Wing (IERW) flight training program. First Interim Report. St Louis, MO: McDonnell Douglas Astronautics Co.

Miller, J. T., Marco, R. A., Eschenbrenner, A. J., & Dohme, J. A. (1980). Mission track job analysis.

Miller, J. T., Marco, R. A., Mocharnuk, J. B., & Dohme, J. A. (1980). Behavioral construct identification.

Miller, N. E. (1946). Psychological research on pilot training in the AAF. *American Psychologist, 1*, 7-16.

Miller, N. E. (Ed.). (1947). *Psychological Research on pilot training. Report No. 8*. Washington, DC: U.S. Government Printing Office.

Miller, R. E. (1960). The Cadet Screening Test as a predictor of AFOQT aptitude composites. Lackland AFB, TX: Personnel Laboratory.

Miller, R. E. (1960). Predicting achievement of cadets in their first two years at the Air Force Academy. Lackland Air Force Base, TX: Wright Air Development Center.

Miller, R. E. (1960). Prediction of Officer Training School criteria from the Air Force Officer Qualifying Test. Lackland Air Force Base, TX: Personnel Laboratory.

Miller, R. E. (1960). Prediction of technical training criteria from AFOQT composites. Lackland Air Force Base, TX: Personnel Laboratory, Wright Air Development Division.

The Air Force Officer Qualifying Test (AFQQT) is used in various officer procurement and selection programs . Scores on this test are of significance in selecting officers for attendance at basic technical courses . A study of 975 reserve officers in seven different technical courses was therefore conducted to provide data on the predictive validities of AFOQT composite scores for final technical course grades . Satisfactory validity coefficients were obtained for the AFOQT aptitude composites against the course criteria . Most of the composites were valid for each separate criterion, and coefficients as high as .58 were obtained . Evidence was found that these validities persist in different samples of officers enrolled in the same course. at different times. Validities of the AFOQT interest composites, however, were markedly fewer and frequently negative. The highest in terms of absolute value was .32 .

Miller, R. E. (1961). The 1961 experimental Air Force Academy Battery. Lackland AFB, TX.

Miller, R. E. (1964). Predicting first year achievement of Air Force Academy cadets class of 1964. Lackland Air Force Base, TX: Personnel Research Laboratory.

Applicants for each Air Force Academy class take a battery of selection tests to establish their qualifications. Entering cadets take an additional battery consisting mainly of nonacademic experimental tests, developed as part of a program for the production of officer selection and classification devices. Both batteries are validated at the end of the fourth class year against academic and nonacademic criteria. In the class of 1964 the criteria were the Academic Standard Score. Cadet Effectiveness Rating (CER), Residualized Cadet Effectiveness Rating (with respect to physical aptitude), Extracurricular Activities Standard Score. Nonacademic Standard score. and Early Motivational Elimination. Using multiple regression techniques, it was found that

there are measures in both the selection and experimental batteries having validity for each of the criteria. Multiple correlations up to .01 were obtained with the Academic score as the criterion, and up to .51 with the CER. Validities are not significantly different from those observed in the class of 1963 for selection tests common to both classes. Previously observed fluctuating validities appear to have stabilized.

Miller, R. E. (1966). Development of officer selection and classification tests - 1966. Lackland AFB, TX: Personnel Research Laboratory.

Miller, R. E. (1966). Relationship of AFOQT scores to measures of success in undergraduate pilot and navigator training. Lackland AFB, TX: Personnel Research Laboratory.

Miller, R. E. (1968). Development of officer selection and classification tests--1968. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E. (1968). Predicting first year achievement of Air Force Academy cadets, class of 1968. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E. (1969). Interpretation and utilization of scores on the Air Force Officer Qualifying Test. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E. (1970). Development and standardization of the Air Force Officer Qualifying Test Form K. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E. (1972). Development and standardization of the Air Force Officer Qualifying Test Form L. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E. (1974). Development and standardization of the Air Force Officer Qualifying Test Form M. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E. (1974). Optimal assignment of Air Force pilots. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, R. E., & Creager, J. A. (1960). The 1960 experimental Air Force Academy Battery. Lackland AFB, TX: Personnel Laboratory.

Miller, R. E., & Creager, J. A. (1960). Predicting achievement of cadets in their first year at the Air Force Academy, Class of 1962. Lackland Air Force Base, TX: Wright Air Development Division.

Miller, R. E., & Valentine, L. D. (1964). Development and standardization of the Air Force Officer Qualifying Test - 64. Lackland AFB, TX: Personnel Research Laboratory.

Mills, J. G., & Jones, D. R. (1984). The Adaptability Rating for Military Aeronautics: An historical perspective and continuing problem. *Aviation, Space, and Environmental Medicine, 55*, 558-562.

Mitchell, H. D. (1942). Aircrew selection. *American Journal of Psychiatry, 99*, 354-357.

Mitchell, T. R., & Albright, D. (1971). Expectancy theory predictions of job satisfaction, job effort, job performance, and retention of Naval aviation officers. Seattle, WA: Advanced Research Projects Agency.

Mitchell, W. (1905). 2nd Lecture on Field Signal Communications: Infantry and Cavalry School, Department of Military Art.

Mohler, S. R. (2001). Louis H. Bauer, M.D., and the first civil U.S. aeromedical standards: his continuing legacy. *Aviation, Space, and Environmental Medicine, 72*(1), 62-69.

Molesworth, B. R. C., & Chang, B. (2009). Predicting pilots' risk-taking behavior through an implicit association test. *Human Factors, 51*(6), 845-857.
Objective: The Implicit Association Test (IAT), in combination with a battery of additional psychometric tests, was employed to examine the accuracy with which it predicts pilots‘ risk-taking behavior. Background: Risk management is an integral part of piloting. Many factors affect pilots‘ risk management, including individual differences. Therefore, employing a unique methodology from social cognition, the present study examined the influence of attitude, as measured implicitly through the IAT, personality, and flight experience variables on pilots‘ risk-taking behavior. Method: In addition to a simulated flight on a computer-based flight simulator, 35 pilots completed a battery of psychometric tests. Results: Among the 6 risk perception variables, 10 risk attitude variables, and 2 experience variables, only 2 variables were found to be significantly related with in-flight risk-taking behavior: everyday risk (risk perception) and the IAT effect (attitude). Of these, the IAT effect was the strongest predictor of flight behavior. Conclusion: The results indicate that implicit attitudinal measures, such as the IAT, provide a more accurate forecast of pilot behavior than do the more traditional explicit attitudinal or personality measures. Application: An implicit attitudinal measure can be proactively employed to identify pilots who are potentially more likely to engage in high-risk activities, hence permitting a more strategic approach to pilot training.

Montagu, L. (Ed.). (1907). *A Short History of Balloons and Flying Machines*. London: The Car Illustrated.

Moore, J. L. (1991). *Aeronautical adaptability of Naval aircrew candidates*. Paper presented at the 33rd Annual Military Testing Association Conference, San Antonio, TX.
The psychiatric qualifications for Naval aviation duty are more stringent than those for general duty and disposition is tied much more closely to diagnosis. These facts apply not only to DSM-IIIR Axis I where diagnoses render an individual "Not Physically Qualified" (NPQ), but also to Axis II diagnoses, Within the Navy, a variety of recommended general duty dispositions may be made by the clinician if a personality disorder is diagnosed. The patient's command may then consider these recommendations in formulating an appropriate administrative action. Separation is either pursued or the patient returns to duty in his or her rated specialty. Within the aviation community, personnel must be found to be both psychiatrically physically qualified (PQ, no Axis I diagnosis) and ,aeronautically adapted (AA, no Axis II diagnosis) in order to

remain on active flight status. The most recent editions of the Navy Manual of the Medical Department (Chapter 15) and the Navy Flight Surgeons Manual state that any Axis II diagnosis is cause for rejection of candidates and disqualification of designated individuals. In addition, prominent personality traits which result in maladaptive behavior, emotional instability, or impaired judgment may render the patient "Not Aeronautically Adapted" (NAA) if safety of flight, crew coordination, or effective mission execution are effected. For all practical purposes, a finding of NAA is considered permanent, and it is for this reason that recent guidelines require that designated individuals be referred to the Naval Aerospace Medical Institute (NAMI) for final determination. Once referred, all patients take the MMPI and complete several clinical interviews. Normative data have been established which improve the sensitivity and specificity of the MMPI within the Naval Aviator and Naval Flight Officer communities. Efforts are currently underway to establish similar norms for the MMPI-2.

Moore, J. L., Berg, J. S., & Valbracht, L. E. (1996). *Prediction of aeronautical adaptability using NEO PI-R facet scores*. Paper presented at the Meeting of the Aerospace Medical Association, Atlanta, GA.

Moore, P. J. (1995). Across airline differences in pilot learning: the roles of experience and qualifications. In N. Johnston, R. Fuller & N. McDonald (Eds.), *Aviation Psychology: Training and Selection* (Vol. 2, pp. 302-307). Aldershot: Avebury.
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Mora, P. B., Rodriguez, P. G., Diez, A. C., Lopez, I. M., & Enriquez, J. S. (2004). Una experiencia en la seleccion de pilotos aereos. *Revista de Psicologia del Trabajo y de las Organizaciones, 20*(2), 249-261.

Morin, D. P. (1997). *Training Air Service Pursuit Pilots in World War I.* Air Command and Staff College, Maxwell AFB, AL.

Morrison, P. L. (2006). *Effectiveness of Introductory Flight Screening (IFS) for United States Navy and Marine Corps Student Pilots.* MS, Naval Postgraduate School, Monterey, CA.

Morrison, T. R. (1988). *Complex Visual Information Processing: a Test for Predicting Navy Primary Flight Training Success*. Naval Air Station, Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Morrison, T. R. (1991). *Validation of Biographical Inventory: U.S. Navy/Marine Corps Aviation Selection Test Battery*. Paper presented at the 27th Meeting of the Department of Defense Human Factors Engineering Technical Advisory Group.

Morrison, T. R. (1991). *Validation of biographical inventory: U.S. Navy/Marine Corps aviation selection test battery*. Paper presented at the 33rd Annual Military Testing Association Conference, San Antonio, TX.
The U.S. Navy is revising the Navy/Marine Corps Aviation Selection Test Battery (ASTB); the existing version has been used since its previous revision in 1971. The ASTB consists of four paper-and-pencil tests: The Academic Qualification Test (AQT) measures

general intelligence. The Mechanical Comprehension Test (MCT) measures the ability to perceive physical relationships and solve practical problems in mechanics. The Spatial Apperception Test (SAT) measures the ability to perceive spatial relationships from differing orientations. The Biographical Inventory (BI) contains items concerning personal history, interests, and aviation knowledge. The MCT, SAT, and BI scores combine to produce the Flight Aptitude Rating (FAR). The ASTB is frequently referred to as the "AQT-FAR with its summary score consisting of two Stanine scores, e.g., 8/6, meaning an AQT Stanine of 8 and a FAR Stanine of 6. The existing BI was validated using Student Naval Aviators (SNAs); however, the BI has also been used to select Student' Naval Flight Officers (SNFOs). Hopson et al. (1978) investigated the relationship between pass-attrite during undergraduate flight training and AQT, SAT, MCT, and BI scores. Their results are reproduced in Table 1. For SNAs, all tests increased the multiple correlation (R); however, for SNFOs, the SAT and BI did not significantly increase R. The purpose of the present study was to develop and validate separate BI scoring keys for SNAS and SNFOs for the Revised ASTB.

Motowidlo, S. J., Dunnette, M. D., & Carter, G. W. (1990). An alternative selection procedure: The low fidelity simulation. *Journal of Applied Psychology, 75*(6), 640-647.

Mouloua, M., Gilson, R., & Hancock, P. (2003). Human-centered design of unmanned aerial vehicles. *Ergonomics in Design, 11*(4), 6-11.

Moxham, P. (2004). To the manor born. *Civil Aviation Training,* 10-12.

Muller, H. L. (1917). *Manual of Military Aviation*: Hollis Leroy Muller.

Mullins, C. J. (1961). An analysis of two measures of self confidence (pp. 1-4). San Antonio: Personnel Research Laboratory.

Mullins, C. J. (1962). Objective tests of self-confidence (pp. 1-5). San Antonio: Personnel Research Laboratory.

Mullins, C. J. (1962). Two measures of decisiveness (pp. 1-4). San Antonio: Personnel Research Laboratory.

Mullins, C. J., Keeth, J. B., & Riederich, L. D. (1968). Selection of foreign students for training in the United States Air Force (pp. 16): Air Force Human Resources Laboratory.

Mullins, C. J., & Massey, I. H. (1970). Why young men apply for Air Force commissions. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Mullins, W. (1993). *Female Combat Helicopter Pilot Selection Criteria.*, Army Command and General Staff College, Fort Leavenworth, KS.

This study investigates selection criteria for selecting female aviators for training in combat helicopters (AH-64, AH-1, OH-58D, and RAH-66). Selection for such training would occur as either a part of the multi-track program of instruction used in the current Initial Entry Rotary Wing flight training course, or as transition training for already qualified aviators.

Analysis included a review of: current Army Regulations governing prerequisites for combat helicopter training and combat helicopter maintenance test pilot training; Initial Entry Rotary Wing selection criteria for combat helicopter tracks (AH-1 and OH-58); Aviation Branch Personnel Manager interviews; Combat Helicopter Manprint/Anthropometric restrictions; Standards of medical fitness; Anthropometric standards; and previous reports on female performance in Initial Entry Rotary Wing training. Conclusion supports selecting females for combat helicopter training using the same selection criteria currently used for choosing males for such training. Study recommends additional research in aircraft accommodation measurements; social-psychological aspects; and physical body strength requirements. Helicopter pilot training, Selecting women aviators, Military helicopter pilot selection.

Munday, A. H. (1917). *The Eyes of the Army and Navy*. New York: Harper and Brothers Publishers.

Murray, M. W., Siem, F. M., Duke, A. P., & Weeks, J. L. (1995). Dimensions of Air Force Pilot Combat Performance. Brooks AFB, TX: Armstrong Laboratory.

Murray, N. L. (1951). Analysis of the navigator-bombardier job and identification of factors contributing to successful performance. Lackland AFB, TX: Air Force Personnel and Training Research Center.

Myers, B. A. (2003). *Soviet and American Airwomen During World War II: A Comparison of Their Formation, Treatment and Dismissal.* MA, Department of History, University of Utah.

Myers, D. C., Jennings, M. C., & Fleishman, E. A. (1982). Validation of cognitive and perceptual-motor tests for assigning pilots to different missions: Job analysis findings. Washington, DC: Advances Research Resources Organization.

Myers, D. C., Jennings, M. C., Schemmer, M., & Fleishman, E. A. (1982). Validation of cognitive and perceptual-motor tests for assigning pilots to different missions: Development of computer-interactive tests. Bethesda, MD: Advanced Research Resources Organization.

The purpose of the present study is to develop a Mission Track Assignment Battery (MTAB) that can be used to assign student pilots to different mission tracks for training depending on their demonstrated skills and abilities. The development of such a testing system will allow the Army to make more effective and efficient utilization of personnel . However, before the test battery could be implemented it was necessary to investigate the nature of the work performed in the different missions and to develop objective and valid instruments which measure the required abilities and predict pilot success and proficiency in training and in the field.

Myers, D. C., Schemmer, F. M., & Fleishman, E. A. (1983). Analysis of computer interactive tests for assigning helicopter pilots to different missions. Bethesda, MD: Advanced Research Resources Organization.

A test battery was developed to represent a broad range of abilities and skills that were

identified as important in piloting helicopters. The battery was developed on the basis of a taxonomic approach to job analysis which linked pilot tasks to ability requirements for different mission tracks. The tests developed were based on an earlier review, by ARRO staff, of the kinds of tests likely to measure the abilities identified in the job analysis approach employed. The present study included the development, programming and pre-testing of computer interactive tests designed to measure abilities as underlying critical tasks in the various helicopter missions. conditions of administration were developed and test reliability Tasks judged by expert pilots to be critical for pilot effectiveness were identified as possible measures of performance in the different mission tracks. These tasks can be translated into criterion measures and used in validating the test battery developed. The purpose of the validation will be to empirically link test scores with performance in these critical tasks representing the different mission tracks. The findings would indicate if all the tests are needed or if empirical validities showed which limited set of tests can be used to predict mission performance.

Myers, D. C., Schemmer, F. M., & Fleishman, E. A. (1985). Development of computer interactive tests for assigning helicopter pilots to different training missions. *Vertiflite, 31*(5), 48-51.

The use of helicopters continues to grow in such areas as law enforcement and military operations . As the aircraft become more technically sophisticated and their missions more complex, increasing demands are placed on the pilots. Consequently, there is a need to improve the effectiveness of the selection and training of pilots to ensure that pilots have the skills and abilities required to operate helicopters effectively and safely. Recently, there have been some developments in the field of human performance measurement which should help to ensure that pilots have the proper skills. More specifically, advances in computer technology such as the success of the microcomputer have opened the way for broader and more cost-effective use of computers in the selection and assignment of personnel. As a result, there has been a growing effort undertaken by the military services and private corporations to make use of the computer's capabilities in selection testing. Currently, the U.S. Army is developing computer-based tests for selecting and assigning Army pilots to different helicopter training missions.

National Research Council (U.S.). Committee on Aviation Psychology. (1949). *Proceedings of a Conference on the Selection and Classification of Enlisted Aviation Personnel, May 6, 1949*. Washington: Division of Aviation Medicine, Bureau of Medicine and Surgery, United States Navy.

National Research Council Committee on Selection and Training of Aircraft Pilots. (1942). An historical introduction to aviation psychology. Washington, DC: Civil Aeronautics Administration.

NATO Advisory Group for Aeronautical Research and Development. (1954). *Methods and criteria for the selection of flying personnel, symposium held 23-25 February 1953, Paris, France*. Paris: North Atlantic Treaty Organization.

Naval School of Aviation Medicine (U.S.). Aviation Psychology Laboratory. (1955). *Research notes from the Aviation Psychology Laboratory; research report of the U.S. Naval School of Aviation Medicine*. Pensacola.

Nelson, J. T., Lefebvre, A. T., & Andre, T. S. (2004). *Managing multiple uninhabited aerial vehicles: Changes in number of vehicles and type of target symbology*. Paper presented at the 2004 Interservice/Industry Training, Simulation & Education Conference, Arlington, VA.

Nelson, R. C. (1992). Toward advanced human reliability programs: Structural development considerations and options for extreme risk environments. Falls Church, VA: Office of Emergency Operations.

Operational populations exposed to extreme risk environments (EREs) might expect to sustain substantial losses, yet must be able to be relied upon to complete their mission or missions regardless. Existing human (personnel) reliability programs are inadequate to assure that personnel capable of meeting both the necessary security and operational requirements are available for response to such conditions. This study explores a number of issues to consider in building a robust human reliability program (HRP) structure capable of supporting single to multiple operational populations, scenarios, and missions, using any of several program structure formats. The HRP structure format may be used within a single agency or government-wide.

Neuman, T. (1972). Personality and adjustment to military flying. A theoretical discussion and analysis of concepts in the light of empirical results. Wright Patterson Air Force Base, TX: Air Force Systems Command Foreign Technology Division.

Newstead, S. E., Irvine, S. H., & Dann, P. L. (Eds.). (1986). *Human Assessment: Cognition and Motivation*. Dordrecht: Martinus Nijhoff.

Newton, T. H. (1961). A new selection system for Air Force Academy cadets. Maxwell Air Force Base, AL: Air University, Squadron Officer School.

Ng, B. L. (1994). Medical selection of military pilots: a Republic of Singapore Air Force perspective. *Annals of the Academy of Medicine, Singapore, 23*(5), 665-668.

A comprehensive selection examination in the Republic of Singapore Air Force (RSAF) aims to minimise medical wastage of military pilots who have to function safely in the unnatural environment. Of the 8642 applicants examined, 657 (7.6%) were rejected for non-medical reasons before completion of medical examination. Of the remaining 7778, 58.7% passed the selection examination while 41.3% failed. Ophthalmological (34.3%), anthropometry (23.7%), and ENT (13.7%) conditions were the three major causes for failure (71.7%). Myopia and astigmatism accounted for 57.6% while squints accounted for 22.1% of the ophthalmological conditions. Amongst ENT conditions, 70.8% were for marked vasomotor rhinitis, sinusitis and nasal septum deviation with marked narrowing of one or both nasal passages, while 22.4% were for permanent abnormal hearing threshold shifts above the minimum standards.

Noble, C. E. (1952). A representative scale of difficulty in the Complex Coordination Test. Lackland Air Force Base: U.S. Air Force Human Resources Research Center.

Nontasak, T., & Dolgin, D. L. (1990). *Differences in Time-Sharing Ability Between Successful and Unsuccessful Trainees in the Landing Craft Air Cushion Vehicle Operator Training*

Program. Paper presented at the 35th Annual Meeting of the Human Factors Society, Santa Monica, CA.

Nontasak, T., Dolgin, D. L., & Blower, D. J. (1991). *Performance Differences in Psychomotor and Dichotic Listening Tests among Landing Craft Air Cushion Vehicle Operator Trainees.* Paper presented at the 35th Annual Meeting of the Human Factors Society, Santa Monica, CA.

Changes in the selection procedures for the U.S. Navy's landing craft air cushion (LCAC) vehicle operator training program are under development. Several cognitive, personality, and psychomotor selection tests are being evaluated. This study analyzed the performance of 36 LCAC operator trainees on an automated series of single and multiple psychomotor (PMT) and dichotic listening (DLT) tests that measure abilities involving eye-hand-foot coordination and divided attention. Point-biserial correlational analyses between test measures and training criteria resulted in a number of statistically significant correlations ($p < .05$). Additional analyses using the t test indicated that successful trainees performed significantly better than unsuccessful trainees on PMT measures ($p < .05$). In multiple task conditions, where PMT and DLT were administered simultaneously, only performance on PMT subtasks indicated significant differences between the two groups. These findings suggest that psychomotor tests have the potential to predict LCAC training program outcome.

Nontasak, T., Dolgin, D. L., & Griffin, G. R. (1989). *Performance-Based Tests, Personality Attributes, and Training Outcome among Landing Craft Air Cushion (LCAC) Vehicle Operators.* Paper presented at the 33rd Annual Meeting of the Human Factors Society.

To date, only limited entry requirements exist for selection of vehicle operators for the U.S. Navy landing craft air cushion (LCAC) vehicle training program. What these requirements should be has not been empirically determined, hence a research effort in this area is needed. An additional impetus for such research has been a series of costly accidents resulting from operator error. Our objectives were to develop a cognitive, psychomotor, multiple-task, and personality-oriented test battery having the potential to predict the training outcome of LCAC operators and serving as an LCAC-personnel screening system. Automated tests used included Dichotic Listening, Psychomotor, Manikin, One-dimensional Compensatory Tracking, Digit Cancellation, and Risk-taking. Significant predictors of training grade criteria included a multiple Dichotic Listening test. Training grade also correlated with the stick-rudder-throttle conditions of the Psychomotor task and with the One-dimensional Compensatory Tracking task when performed in combination with the Digit Cancellation task. Risk-taking tendencies were also significantly related to overall training grade. These findings suggest that components of the test battery have the potential to predict LCAC training performance.

Nontasak, T., Gibb, G. D., & Thomas, A. (1988). Determinants of naval flight officer program entry and pipeline choices. *Aviation, Space, and Environmental Medicine (News Note), 59*(1), 74-77.

Nooy. (1987). *Ab-initio training of airline pilots*. Paper presented at the Fifth International Symposium on Aviation Psychology.

Norman, R. D. (1947). Comparison of earlier and later success in Naval aviation training.

Journal of Applied Psychology, 31, 511-518.

Norman, W. T. (1962). Validation of personality tests as measures of trait-rating factors. Lackland Air Force Base, TX: 6570th Personnel Research Laboratory.

As the final phase of a test-development project, 3 forced -choice self-report tests were administered to student groups to develop empirical scales predictive of peer-nomination personality ratings drawn from the same groups. Five factor scales were developed for each test. For the independent sample of a double cross-validation analysis , all of the scales correlated positively with their criteria. Combined scales for the 3 tests showed usefully high correlations . Multiple regression analyses demonstrated that scores from other personality tests administered to the students did not add appreciably to prediction of the peer-nomination scores. The self-report tests yield better prediction (.38-.47) of 3 of the peer-nomination factors (Extroversion, Conscientiousness , Culture) than of Agreeableness (.31, 1.34) or Emotional Stability (.26, .29). From a second administration of the self-report tests with instructions to fake responses favorable for acceptance for officer training , detection keys were derived that identified a high percentage of faked performances , and factor scales were developed which reduced the occurrence of faked scores in the extremes of the distributions.

North Atlantic Treaty Organization. Advisory Group for Aerospace Research and Development. Aerospace Medical Panel. (1966). *Assessment of skill and performance in flying; proceedings of the 23rd annual meeting of the AGARD Aerospace Medical Panel held in Toronto, Canada. 7th September, 1966*. Paris,.

North, R., & Gopher, D. (1974). *Basic attention measures as predictors of success in flight training*. Paper presented at the 18th Annual Meeting of the Human Factors Society.

North, R. A. (1977). *Task Functional Demands as Factors in Dual-Task Performance.* Paper presented at the 21st Annual Meeting of the Human Factors Society, San Francisco, CA.

North, R. A. (1977). Task components and demands as factors in dual-task performance. Bolling Air Force Base, DC: Air Force Office of Scientific Research.

North, R. A., & Gopher, D. (1976). Measures of Attention as Predictors of Flight Performance. *Human Factors, 18*(1), 1-14.

A new technique for measuring individual differences in basic attention capabilities and the validity of these differences in predicting success in flight training were investigated. The testing system included a digit-processing, reaction-time task and a one-dimensional compensatory tracking task. Comparisons were made between separate and concurrent performances of these tasks, with both equal and shifting task priorities. Adaptive techniques were employed to obtain maximum performance levels for each subject in the single-task condition and to maintain dual-task difficulty within subjects. Consistent individual differences in basic attention capabilities were observed and several dimensions of attention capabilities are suggested. A preliminary validation study compared scores for flight instructors and student pilots. In addition, the student sample was dichotomized based on performance in training. There were reliable differences for both groups on dual-task performance efficiency.

North, R. A., & Griffin, G. R. (1977). Aviator Selection 1919 -1977 (pp. 57). Pensacola, FL: Naval Aerospace Medical Research Laboratory.

North, R. A., Harris, S. D., & Owens, J. M. (1978). Test-Retest Reliability of Individual Differences in Dual-Task Performance. Naval Air Station, Pensacola, FL: Naval Aeromedical Research Laboratory.

Recent research in predicting aviator performance in flight training from measures of divided attention performance has emphasized the need for the development and refinement of testing methods, investigation of the range and consistency of the individual differences associated with the measures, and the relationship of these measures with score on existing paper-and-pencil tests currently used for selection of aviators. Gopher and North indicated that there was a wide-range of individual differences in single and dual task performance of one-dimensional, compensatory tracking and a discrete, digit-processing, reaction-time task. Furthermore, there were low and non-reliable correlations between single-task performances and generally low and non-reliable correlation between single and comparable dual-task score for each task. These results suggested that the chosen tasks represented independent performance abilities, and that single-task performance was independent from time-sharing performance. In addition, the individual differences demonstrated in time-shared performance were consistent across various experimental manipulations of task priorities in the study, indicating a high degree of reliability of these measures. The coals of this study were to investigate (1) test-retest reliability coefficients of single and dual-task performance measures over separate test days$ (2) the range and consistency of individual differences in the measures and degree of relationship of the attention scores to scores on a standard set of aviation selection tests, including the Academic Qualification Test (AQT), Mechanical Comprehension Test (MCT), Spatial Apperception Test (SAT), and Biographical Inventory (BI). The investigation of these relationships is at important initial step in planning subsequent investigations of the validity of these attention measures as predictors of performance in various phases of naval aviation training. Test-retest reliability is important in ensuring that changes in subject motivational levels, physiological states, or rate of skill acquisition do not bias the measurement of the skills being assessed from day to day. Relationships between single- and dual-task performance are important in determining the independence of time-sharing of the candidate from separate task performance capability. The correlation of attention measures with the paper-and-pencil tests will determine the feasibility of continuing the investigation of these measures as independent predictors of aviator performance.

Novello, J. R., & Youssef, Z. I. (1974). Psychosocial Studies in General Aviation: 1. Personality Profile of Male Pilots. *Aerospace Medicine*.

Novello, J. R., & Youssef, Z. I. (1974). Psycho-social studies in general aviation: II. Personality profile of female pilots. *Aviation, Space, and Environmental Medicine, 45*, 630-633.

Novis Soto, M. L. (1998). Influencia del sexo en aptitudes medidas por tests de lapiz y papel en la seleccion de candidatos a pilotos de linea aerea. *Medicina Aeroespacial y Ambiental, 2*(4), 192-197.

Novis Soto, M. L. (1998). Los cuestionarios de personalidad en la seleccion de pilotos de linea aerea. *Revista de Psicologia del Trabajo y de las Organizaciones, 14*(1), 113-128.

Oberman, A., Lane, N. E., Mitchell, R., & Graybiel, A. (1965). The Thousand Aviator Study: Distributions and Intercorrelations of Selected Variables Naval Air Station, Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Oberman, A., Mitchell, R., & Graybiel, A. Thousand aviator study. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

O'Connor, W. F., & Ambler, R. K. (1959). Prediction of pre-flight navigation performance and selection of navigator-bombardiers. Pensacola, FL.

O'Donnell, R., & Brown, W. R. (1984). Inflight performance of Army student aviators in relationship to new anthropometric selection standards. Fort Rucker, AL.

O'Donnell, R., Moise, S., Warner, D. A., & Secrist, G. (1994). Enhancing Soldier Performance: A Nonlinear Model of Performance to Improve Selection Testing and Training (pp. 69). Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.

Advanced U.S. Army technology and hardware systems place a higher cognitive demand on the individual soldier than ever before. Sophisticated weaponry and hostile mission environments of modern conflict threaten to overwhelm the capacities of the human operator. New selection and training instruments are being developed to (a) select people most likely to perform well under high cognitive demands, (b) identify weaknesses in people, and (c) alter or train the person to improve response to the increased cognitive work load. The primary goals of this Phase I SBIR effort were to develop a new conceptual model and to suggest new testing and training approaches to handle the cognitive complexity of many Army tasks. Such approaches may enhance the identification and training of people to perform cognitive tasks efficiently during conditions of extremely high work load. To begin this process, a general "nonlinear" model of performance was first developed by exploring performance theory; this theoretical orientation was then translated into practical assessment and training tools to select and enhance people likely to excel at tasks demanding particular combinations of skills. A nonlinear approach to combining these procedures into a practical "test battery" and a specific training approach based on this model were proposed.

O'Hare, D. (1997). Cognitive ability determinants of elite-pilot performance. *Human Factors, 39*(4), 540-552.

The role of the modern pilot requires a high degree of situational awareness. This involves the ability to search for relevant information, assess opportunities and priorities, and maintain performance under stress. The PC-based WOMBAT[TM] test has been designed to measure individual aptitude to cope with such demands. In the first experiment performance on the WOMBAT test was compared with performance on a batter of tests of specific underlying abilities. In the second experiment the performance of elite soaring pilots was compared with that of matched pilot and control groups. The results support the theory that the WOMBAT test measures individual ability to maintain situational awareness and that this ability is found in high levels in elite pilots.

O'Hare, D. (2006). Cognitive functions and performance shaping factors in aviation accidents

and incidents. *International Journal of Aviation Psychology, 16*(2), 145-465.

Is the difference between an accident and an incident merely a matter of luck, or are there significant differences in terms of flight crew performance and associated performance shaping factors (PSFs)? This study obtained self-report data from a sample of 1,144 New Zealand pilots. There were differences between accident- and incident-involved pilots in terms of age, flight experience, and involvement in hazardous events. Incidents were more likely to be attributed to failures to detect or diagnose information, whereas accidents were more likely to be attributed to failures to choose an appropriate goal or strategy. There was no difference in the quantity of PSFs associated with accidents and incidents. These self-report data are consistent with previous findings based on external coding of air accident reports.

O'Hare, D., & O'Brien, K. (2000). Individual differences in situational awareness and training for complex tasks. In A. R. Lowe & B. J. Hayward (Eds.), *Aviation Resource Management (Vol. 2)*. Aldershot: Ashgate.

Ohio State University. Research Foundation., Fitts, P. M., & United States. Air Navigation Development Board. (1951). *Human engineering for an effective air-navigation and traffic-control system*. Washington,: National Research Council, Division of Anthropology and Psychology, Committee on Aviation Psychology.

Olea, J., Ponsoda, V., & Prieto, G. (Eds.). (1999). *Tests Informatizados: Fundamentos y Aplicaciones*. Madrid: Ediciones Pir-mide.

Olea, M., & Ree, M. J. (1994). Predicting pilot and navigator criteria: not much more than g. *Journal of Applied Psychology, 79*(6), 845-851.

A comparison of the validity of psychometric g and specific ability or job knowledge, s, for predicting pilot and navigator criteria was conducted. Psychometric g and s were estimated from the principal components of a multiple aptitude test battery. The criteria included passing-failing training, an overall performance composite, academic performance, and work samples of pilot and navigator tasks. Regression analyses conducted to evaluate the predictive efficiency of g and s demonstrated that g was the best predictor of all criteria and s contributed little beyond g.

Olea, M. M., & Ree, M. J. (1993). Predicting aircrew training performance with psychometric *g*. Brooks Air Force Base, TX: Armstrong Laboratory.

The situation awareness (SA) and mental workload of 56 subjects were evaluated as they monitored one or more attributes of six objects moving systematically over a rectangular grid. Subjects were assigned to one of seven groups depending upon whether they were to monitor object locations (location task), object colors (color task), whether the objects flashed (flash task), or some combination of these three . Both task performance and subjective ratings were used to assess subjects ' awareness of the three object attributes. In addition, subjective ratings of mental workload were collected . All subjects performed the monitoring task under four different conditions formed from the factorial combination of 1) the probability that objects of a certain color would flash and 2) whether object colors remained consistent or changed during the course of a trial. The results pointed to the usefulness of both flash and color task performance as measures of SA. Subjects were very poor at the location task, suggesting either their location awareness was poor or the location task is not a good measure of that awareness . Subjective

ratings proved useful but occasionally dissociated from task performance . One possibility is that subjective ratings reflect rational inferences b the subjects rather than the outcome of their introspections.

Oosterhof, A. C., & Dohme, J. A. (1984). Evaluation of the Revised Flight Aptitude Selection Test for Possible Bias and Development of Experimental Unbiased Items. Fort Rucker, AL: Army Research Institute Field Unit, Fort Rucker, AL.

Oosterhoff, A. C., Atash, M. N., Douglas, K. A., Lassiter, K. L., & Thompson, T. J. (1983). Report on the revision of the current form and development of a parallel form to the Flight Aptitude Selection Test. Tallahassee, FL: Florida State University.

Oosterhoff, A. C., Atash, M. N., & Lassiter, K. L. (1981). Evaluation of the Revised Flight Aptitude Selection Test for possible bias and development of experimental unbiased items. Tallahassee, FL: Florida State University.

In November, 1980, the Army Research Institute through it Fort Rucker Field Unit and Florida State University initiated a three-year research project to evaluate the Revised Flight Aptitude Test (R-FAST) for possible sex and racial bias, and to develop experimental test items if bias in the present instrument was observed . This project is being conducted in four phases. The first phase included the evaluation of the R-FAST for possible bias. Parallel and experimental Item forms and test items are to be developed in the second phase. The experimental Items are to be correlated with the parallel items and validated against a criterion standard in the third phase . The Performance - based Aviator Selection System (PASS), currently being validated at Fort Rucker, will represent the criterion in the third phase. The experimental items are to be correlated against final IERW grades in the fourth phase.

Orme, D. R. (2003). The path back to the cockpit: FAA and USAF procedures for head-injured aviators. *Human Factors and Aerospace Safety, 3*(4), 353-364.

Ornstein, G. N. (1954). Stanine as a predictor of pilot performance on specific maneuvers. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Osnabruegge, G. (1992). International application of the DLR test-system: Continuation of the cooperation with IBERIA in pilot selection. Koeln (Germany): Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR).

Otte, R. (1984). *Stratifying Air Crew Membership: A Pre-Selection Model*. Paper presented at the 26th Annual Military Testing Association Conference, Munchen, FRG.

Most of the young men who want to join the Air Force as a pilot must become officers and have to pass the Central Personal Office, the only selection institution of the German Armed Forces to test the personal conditions of all applicants for all 3 branches of the Bundeswehr. For further information of the fundamentals and the diagnostic methods used for the selection of officer candidates please join the report of KLASSMANN. The holistic assessment concept of different qualification levels for an officer career requires different psychodiagnostic methods like psychometric measurements, written data (essays, questionnaires) and behavioral observations and assessments by a testboard (2 officers, 1 psychologist) in an interview, round-

table-discussion, short-cut lecture role plays and sports. The selection concept and the criteria which are run to accept or reject an applicant require for the fulfillment of the general officer assignments in different military fields, but do not regard to the particular requirements of the Flying Services.

Ovington, A. (1920). *An Aviator's Wife*. New York: Dodd, Mead and Co.

Ovington, E. (1914). The Psychic Factors in Aviation. *Journal of the American Medical Association, LXIII*(5), 419-420.

Owens, J. M., Goodman, L. S., Pollack, J. G., & Braune, R. J. (1983). *Testing for job proficiency in Naval Aviation: Recent developments and new initiatives in performance-based screening*. Paper presented at the 25th Annual Military Testing Association Conference, Gulf Shores, AL.

Packard, J. M., & Graybiel, A. (1952). Ten year follow-up study of one thousand aviators. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Page, H. E. (1948). A cumulative record of Naval aviator proficiency. *Journal of Aviation Medicine, 19*, 211-218.

Page, H. E. (1951). Historical background and organization of the pilot candidate selection research program. Brooks AFB, TX: U.S. Air Force School of Aviation Medicine.

Page, V. W. (1918). *The A-B-C of Aviation*. New York: Norman W. Henley Publishing Company.

Palmer, F. (1910). *Danbury Rodd Aviator*. New York: Charles Scribner's Sons.

Park, K. S., & Lee, S. W. (1992). A computer-aided aptitude test for predicting flight performance for trainees. *Human Factors, 34*(2), 189-204.

Perceptual/psychomotor and cognitive tasks in a computer-aided aptitude test were studied to predict the success of a trainee in flight training. Pilots' tasks were tentatively classified into five categories : tracking, reaction, memory, estimation, and visual scanning. To investigate the performance of a trainee in these categories, 16 single tasks and 10 dual tasks were examined. In the factor analyses three common factors (tracking, reaction, and memory) were meaningfully extracted. To select significant tasks for predicting flight performance, we performed stepwise regression and discriminate analyses. In the regression analyses, memory tasks were most significant in predicting the flight performance of a trainee. In the discriminate analyses, tracking tasks were most significant for distinguishing the passing and failing groups.

Parker, J. F., & Fleishman, E. A. (1959). Prediction of advanced levels of proficiency in a complex tracking task. Wright-Patterson Air Force Base, OH: Aerospace Medical Laboratory.

Two hundred and three Air Force ROTC subjects were administered a large battery of printed and apparatus psychomotor reference tests from which 50 scores were taken. Following

administration of the reference tests, subjects devoted 17 sessions distributed over a six-week period to practice on a complex tracking task. The matrix of intercorrelations among these scores was factor analyzed and 15 ability factors identified. An analysis then was conducted of the extent to which variation in performance in tracking at the different stages of practice could be accounted for in terms of the identified ability factors. The ability factors accounted for only a small portion of the variance in tracking performance. Hypotheses are offered concerning the selection of a different set of reference measures which might be more effective. The analyses of these data do indicate, however, that the prediction of terminal tracking proficiency is better accomplished through a set of external measures than through initial scores taken directly from the tracking task. Early proficiency on the task itself was unrelated to terminal proficiency.

Parker, J. F., & Fleishman, E. A. (1960). Ability factors and component performance measures as predictors of complex tracking behavior. *Psychological Monographs*(17 (Whole No. 503)).

Parry, J. B. (1947). The selection and classification of R.A.F. aircrew. *Occupational Psychology, 21*, 158-167.

Passey, G. E., & McLaurin, W. A. (1966). Perceptual-Psychomotor tests in aircrew selection: Historical review and advanced concepts. Lackland Air Force Base: Personnel Research Laboratory.

This report reviews the literature reflecting the employment of perceptual-psychomotor tests for selection of aircrew members since World War II and provides behavioral concepts for consideration as possible future test development areas. The review considers the use of flight experience as well as perceptual-psychomotor screening devices and comments on the results of the programs in which such experience is intentionally used. The fundamental importance of criterion definition to development and validation of selection devices is discussed. Recent research is reviewed leading to the derivation of behavioral concepts recommended for consideration as principles on which new perceptual-psychomotor tests may be based. The merits of simple tests as opposed to complex tests in which numerous facets of performance are concurrently assessed are considered and the latter approach is recommended. References are included in support of the review and critical items are annotated.

Paton, S. P., Maclake, W., & Hamilton, A. S. (1918). Personality Studies and the personal equation of the aviator. *Mental Hygiene, 2*(4), 629-634.

Patterson, J. C. (1991). *Clinical assessment of pilots: Selection and retention issues*. Paper presented at the 33rd Annual Military Testing Association Conference, San Antonio, TX.

Aviation is a unique military occupation which requires a substantial amount of psychological resources from those who fly. As such, military aviation has a long, though somewhat uncomfortable relationship with psychological assessment. Psychologists were involved in aviation selection as early as 1919 (Henman) and we continue to be involved with aeromedical and selection research, as well as pilot selection, and clinical assessment of pilots for return to duty (retention) to this day. In some instances, however, psychologists are distrusted for fear that psychological information will be misused. This paper will discuss the issues of psychological assessment in the areas of aviator selection and retention. The issues involved with

the purpose of assessment, methods of assessment, and focus of assessment will be discussed.

Patterson, J. C. (1995). Astronaut selection (NASA-MIPR). Brooks Air Force Base, TX: Armstrong Laboratory.

Paullin, C., Katz, L., Bruskiewicz, K. T., Houston, J., & Damos, D. (2006). Review of Aviator Selection. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

This report presents a review of research in the aviator selection and general personnel selection domains. That information was used to identify knowledge, skills, attributes, and other factors that should be included in a job analysis focusing on the Army aviator job. It was further used to develop a recommended strategy for an Army aviator selection battery.

Paulsen, V. (1917). *U.S. Army Facts and Insignia* (5 ed.). Chicago: Rand McNally and Co.

Payne, R. B., Rohles, F. H., & Cobb, B. B. (1952). The pilot candidate selection program. IV: Test validities and intercorrelations: U.S. Air Force School of Aviation Medicine.

Pederson, H. K., Cooke, N. J., Gesell, L., Hartman, J., Pack, W., & Skinner, M. (2007). *Human factors in UAS training*. Paper presented at the 14th International Symposium on Aviation Psychology, Dayton, OH.

There is currently a surge in the utilization of Uninhabited Aerial Systems (UAS). Although the importance of the human in the system is often ignored with a focus upon the physical airframe, there are nevertheless numerous human factors issues that must be considered one of which is the training of operators. This paper will describe the inventory and assessment of existing U.S. military and civilian UAS operator training activities and programs conducted by the Arizona State University group of the UAV Alliance, Research, and Curriculum Development Partnership Program. The paper will then discuss various avenues of future research pertinent to operator training including what training backgrounds UAS operators should possess, issues in team training, and use of simulators.

Pederson, L. A., Allan, K.E., Laue, F.J., Johnson, J.R. and Siem F.M. (1992). Personality Theory for Aircrew Selection and Classification. Brooks AFB, TX: Armstrong Laboratory.

Growing acceptance of a taxonomy of personality traits developed by the Air Force In the late 1950s (Tupes & Christal, 1961) has prompted a reexamination of the utility of personality measures for aircrew selection and classification research. Candidate theories are identified and then evaluated according both to general scientific criteria and to specific operational criteria (e.g., Hall & Lindzey, 1978; Imhoff & Levine, 1981). The Five Factor Model (Goldberg, 1990; McCrae & Costa, 1985; Tupes & Christal, 1961) is selected as the most suitable framework for guiding future Air Force research in the personality domain. Example items to measure relevant characteristics are proposed, as are directions for future research.

Pelchat, D. (1997). *The Canadian Automated Pilot Selection System (CAPSS): Validation and Cross-validation Results*. Paper presented at the 9th International Symposium on Aviation Psychology, The Ohio State University.

Pelchat, D. W. (1999). Analysis of the Canadian Automated Pilot Selection System (CAPSS): Findings from the first two years of operation. Ottawa, ON: Director Human Resources Research and Evaluation.

Pelegrin, C., Maho, V., & Amalberti, R. (1995). Pilot age and training performance. In N. Johnson, R. Fuller & N. McDonald (Eds.), *Aviation Psychology: Training and Selection* (Vol. 2, pp. 354-363). Aldershot, Hants: Avebury Aviation, Ashgate Publishing.

Perceptronics. (1986). Complex Cognitive Assessment Battery (CCAB): Test administrator user's guide. Los Angeles, CA: Analytical Assessments Corporation.

Perry, D. C., Howse, W. R., & Dolgin, D. L. (1992). Pilot selection special topic group report to the TAPSTEM joint technology coordinating group for manpower and personnel. Washington, DC: Training and Personnel Systems Science and Technology Evaluation and Management Committee.

An evaluation of Any, Air Force and Navy pilot selection and classification research and operational selection procedures resulted in several conclusions. The services share significant commonalities. For example, all three services utilize paper and pencil tests for pilot selection that are augmented by computerized, performance-based selection or classification tests and the individual selection systems assess common personal attributes. All three services have documented that computerized testing improves accuracy for predicting success in flight training beyond that of paper and pencil testing alone . The working group found that the requisite skill, abilities and attributes for completion of flight training are similar for Army, Navy and Air Force. This is supported by the fact that the services test similar domains in their respective selection programs. Although no service currently has the resources to properly maintain a computer test battery while improving aviation selection technology, their pooled resources could support a single battery. It is recommended that the services consolidate administration, maintenance, and research and development of a common computer test battery to select and classify aviation candidates. This consolidation could provide a significant savings over the cost of each service conducting its own test maintenance and research programs.

Perry, D. C., Robinson, D., Amnotte, R., Payne, N., Nguyen, T., Washer, B., & Grubbs, A. (1987). *Porta-Bat User's Guide II: The upgrade*. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Peterson, F. E., Booth, R. F., Lane, N. E., & Ambler, R. K. (1967). Predicting success in naval flight officer training. Naval Air Station Pensacola, FL: Naval Aerospace Medical Institute.

Peterson, F. E., & Lane, N. E. (1966). The relationship of college major to success in Naval aviation training. Pensacola, FL: U.S. Naval Aerospace Medical Institute.

Peterson, F. E., Lane, N. E., & Ambler, R. K. (1966). Carefulness peer ratings as a predictor of success in naval aviation training. Pensacola, FL: U.S. Naval Aerospace Medical Institute.

Cadets were instructed to indicate whether each of the other members in their class was

"were careful" or "less careful" than themselves . The Carefulness Ratings (CR) were correlated with scores on each of the primary selection tests and grades in the U.S. Naval School, Pre-Flight, and the addition of CR to the validity of the Pensacola Student Prediction System was investigated. Carefulness Ratings had significant relationships to the majority of the primary selection tests and Pre-Flight grades currently employed as predictors. For this reason, despite a significant relationship of CR to the criterion of success/failure, its unique contribution was too small to be of practical value.

Peterson, F. E., Lane, N. E., & Kennedy, R. S. (1965). The relationship of the Edwards Personal Preference Schedule to success in Naval flight training. Pensacola, FL: U.S. Naval Aerospace Medical Institute.

The Edwards Personal Preference Schedule, a forced-choice personality "need" inventory, was evaluated as a predictor of success in naval flight training. The EPPS failed to discriminate between student aviators who completed training successfully and those who dropped voluntarily or failed due to poor performance. The schedule showed little promise as a predictive instrument for flight training.

Peterson, F. E., & Pomarolli, R. S. (1966). Academic grades in primary flight training as predictors of flight success. Pensacola, FL: U.S. Naval Aerospace Medical Institute.

Academic grades received during primary training were evaluated as predictors of success in naval aviation training. The addition of primary academic grades to the current prediction formula resulted in a significant increase in its predictive effectiveness.

Petho, F. C. (1981). Interim report on the development of a student aviator/flight officer information management system, selection and flight training research, and operational product. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Petho, F. C. (1993). *A History of Naval Aviation Psychology During World War Two*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

This paper presents a history of naval aviation psychology from the onset to the close of the Second World War. It is based upon archives from the files of the first Aviation Psychology Section in the Navy‘s Bureau of Medicine and Surgery. The paper discusses the evolution of the first naval aviation selection tests and early organizational considerations which ultimately led to the formal establishment of aviation psychology in the Navy.

Petho, F. C., Collyer, P. D., & Sanders, C. M. (1981). *Psychomotor test performance in primary flight training*. Paper presented at the Annual Scientific Meeting of the Aerospace Medical Association, San Antonio, TX.

Pettitt, M., & Dunlap, J. (1995). *Psychological factors that predict successful performance in a professional pilot program*. Paper presented at the 8th International Symposium on Aviation Psychology, The Ohio State University, Columbus, OH.

Phelan, J. G., & Khoury, N. (1969). Culture-fair tests of vocational aptitude: Prediction of on-job engineering aide performance from an object-sorting concept-formation recognition task.

Experimental Publication System(2 Ms. No. 059A).

Professionals in personnel research have long been searching for a culture-fair predictor of Scholastic Aptitude which might indicate future-potential success in relatively complex technician - level jobs of Ss (those educationally disadvantaged, but with hidden and hard-to-measure potential) Guion (1965). Working with similar kinds of situations, Safford (1967) employed Dunn's Object-Sorting Task to predict academic performance of school children. Prediction is the prime concern of personnel research. In personnel psychology, the problem often boils down to the prediction of adequate performance on moderately complex, technician - level jobs . Typically, the familiar measures of "scholastic aptitude" (which admittedly tend to reflect a bias in favor of the length and location of schooling) have been the best single predictor of achievement , and supervisors ' rating been the most often used criteria] measure of job proficiency.

Phillips, F. S. (1964). Computerized man-job matching of Air Force officers: A look at capabilities and concepts. Maxwell Air Force Base, AL: Air University.

Phillips, H. L., Arnold, R. D., & Fatolitis, P. (2003). *Validation of an Unmanned Aerial Vehicle Operator Selection System*. Paper presented at the 45th Annual International Military Testing Association Conference, Pensacola, FL.

The purpose of this study was to validate selection performance standards for the screening of candidates for entrance into the US Navy and Marine Corps Unmanned Aerial Vehicle (UAV) Pioneer Pilot training program. A minimum Pioneer crew consists of an external pilot (EP), internal pilot (IP), and a mission commander/payload specialist (MC). The EP is responsible for take-offs, landings, and control of the vehicle when it is within visual range. The IP is responsible for control of the aircraft when it is beyond visual range. The MC is responsible for planning and execution of the mission, operation of the payload, and for information gathering during the mission. In the development and initial validation phases of this system, a task analysis was completed in training and fleet squadrons to identify both tasks that are critical for safe flight and skills required to perform piloting tasks. Specific computer-based psychomotor tests were chosen as predictor variables based on the task analysis and initial validation. In the present study subjects consisted of 39 students: 5 IPs and 34 Ground Control Station Operators (who received combined IP and MC training) for whom both psychomotor test battery scores and training outcome data were available. A single, four-component, unit-weighted, composite scoring algorithm was generated to indicate performance on the computerized test battery. This composite score was found to be a significant predictor of final average in primary UAV training ($r = .59$, $p < .001$). Mean composite scores also significantly differed between students who ultimately qualified as operators in their operational fleet units and those who failed to qualify ($t = -2.92$ (37), $p < .01$).

Pian, C., Kokorian, A., & Burke, E. (1997). *Defining the critical aptitudes for attack helicopter crews*. Paper presented at the 9th International Symposium on Aviation Psychology, Columbus, OH.

Picano, J. J. (1990). An empirical assessment of stress-coping styles in military pilots. *Aviation, Space, and Environmental Medicine, 61*, 356-360.

Picano, J. J. (1991). Personality types among experienced military pilots. *Aviation, Space, and Environmental Medicine, 62*, 517-520.

Picano, J. J., & Edwards, H. F. (1996). Psychiatric syndromes associated with problems in aeronautical adaptation among military student pilots. *Aviation, Space, and Environmental Medicine, 67*(12), 1119-1123.

Plantenius, P. H., & Wilde, G. J. S. (1989). Personality characteristics related to accident histories of Canadian pilots. *Aviation, Space, and Environmental Medicine, 60*, 42-45.

Poe, A. C. (1953). Effectiveness of the flight aptitude rating battery for the selection of naval aviation cadets. Pensacola, FL: Naval School of Aviation Medicine.

Poe, A. C., & Ambler, R. K. (1952). A comparison of test weighting techniques for the Flight Aptitude Test Battery. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Poe, A. C., & Ambler, R. K. (1954). The evaluation of a forced choice rating form for determination of the leadership potential of pre-flight NAVCADS. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Pohlman, D. L., & Fletcher, J. D. (2010). Personnel selection and training. In J. A. Wise, V. D. Hopkin & D. J. Garland (Eds.), *Handbook of Aviation Human Factors, 2nd Ed*. New York: CRC Press.

This chapter focuses on the selection and training of people who work in aviation specialties. Aviation work encompasses a full spectrum of activity from operators of aircraft (ie pilots), to flight attendants, dispatchers, flight controllers, mechanics, engineers, baggage handlers, ticket agents, airport managers, and air marshals. The topic covers a lot of territory. For manageability, we concentrated on three categories of aviation personnel: pilots and aircrew, maintenance technicians, and flight controllers. One problem shared by nearly all aviation specialties is their workload. Workload within most categories of aviation work has been increasing since the beginning of aviation. In the earliest days, available technology limited what the aircraft could do, similarly limiting the extent and complexity of aircraft operations. Pilots flew the airplane from one place to another, but lacked instrumentation to deal with poor weather conditions-conditions that were simply avoided. Maintainers serviced the airframe and engine, but both of these were adapted from relatively familiar, non-aviation technologies and materials. Flight controllers, if they were present at all, were found standing on the airfield waving red and green flags. Since those days, aircraft capabilities, aircraft materials, and aviation operations have progressed remarkably. The aircraft is no longer a limiting factor. Pilots, maintainers, and controllers are no longer pushing aviation technology to its limits, but are themselves being pushed to the edge of the human performance envelope by the aircraft that they operate, maintain, and control. To give an idea about the work for which we are selecting and training people, it may help to discuss the workloads that different specialties impose on aviation personnel. The following is a short discussion about each of the three selected aviation specialties and the workloads that they may impose.

Pomarolli, R. S. (1966). Perceptions and attitudes of aviators toward voluntary withdrawal from

flight training. Pensacola, FL: Naval Aerosapace Medical Institute.

Pomarolli, R. S. (1966). Psychological factors in voluntary withdrawal from flight training. Pensacola, FL: U.S. Naval Aerospace Medical Institute.
The Edwards Personal Preference Schedule, a forced-choice personality "need " inventory , was evaluated as a predictor of success in naval flight training. The EPPS failed to discriminate between student aviators who completed training successfully and those who dropped voluntarily or failed due to poor performance. The schedule showed little promise as a predictive instrument for flight training.

Pond, D. J., DesRochers, D. L., & Driskell, J. E. (1986). Human performance task batteries and models: An abilities-based directory. Orlando, FL: Naval Training Systems Center.

Poppen, J. R. (1941). Recent trends in aviation medicine. *Journal of Aviation Medicine, 12*, 53-71.

Porter, H. B. (1940). The primary flight phase: A psychological consideration of early instruction in flying. *Journal of Aviation Medicine, 11*, 112-120.

Porter, H. E. (1921). *Aerial Observation: The Airplane Observer, the Balloon Observer, and the Army Corps Pilot*. New York: Harper and Brothers.

Portman-Tiller, C. A., Biggerstaff, S., & Blower, D. (1999). *Relationship Between the Aviation Selection Test and a Psychomotor Battery*. Pensacola, FL.
The current selection tool used by the U.S. Navy and Marine Corps for its aviation officer program is a paper-and-pencil test that measures academic aptitude. There are no other tests in operational use that measure the psychomotor skills and cognitive processing skills that aviators need to fly. The Naval Aerospace Medical Research Laboratory (NAMRL) is currently evaluating the use of such a test. The purpose of this study was to establish the relationship between the paper-and-pencil Aviation Selection Test Battery that is currently being used and a Computer-Based Performance Test (CBPT). A factor analysis resulted in a four factor model accounting for 66% variance. The four factors measured by the CBPT and ASTB include tracking, quantitative skills, dichotic listening, and spatial abilities. Neither of the test batteries fully loaded on all factors. This indicates that while there are some similarities between the two test batteries (i.e. math skills, spatial apperception), there are also some important differences (e.g. dichotic listening and tracking) between the two test batteries. These differences may prove to be beneficial for future aviation selection tests.

Prew, S.-J. (1997). Pilot selection and recruitment. *Civil Aviation Training, 8*(5), 12-16.

Proctor, R. W., Wang, D. Y., & Pick, D. F. (1998). An empirical evaluation of the SYNWORK1 multiple-task work environment. *Behavior Research Methods, Instruments, & Computers, 30*(2), 287-305.

Prophet, W., W. (1969). Prediction of aviator performance. Alexandria, VA: Human Resources Research Office.

Prophet, W. W. (1972). Performance measurement in helicopter operations. Alexandria, VA: Human Resources Research Organization.

Prunkl, P. R. (1969). Factors in predicting Army aviator performance: Birth order and participation in dangerous sports activities. Alexandria, VA: Human Resources Research Organization.

The concept of birth order and its effects have intrigued psychologists for at least a century. Beginning with Sir Francis Galton's study of intellectual eminence in 1874 (1), many studies have shown clear differences between first- and later-born individuals on a wide variety of variables. Among these are differences in intelligence college attendance, willingness to volunteer, schizophrenia, dependency, affiliation need, and various measures of performance. One difference, found by Schacter (2) and of particular interest to aviation psychologists, was for reaction to stress. In his laboratory studies, Schacter allowed students who were waiting for what was assumed to be mild or extremely painful shock either to wait alone or with someone . lie found that his subjects who were first or only children showed a greater desire for affiliation under these conditions than later borns.

Prunkl, P. R., & Boyles, W. R. (1968). *A preliminary application of the critical incident technique to combat performance of Army aviators*. Paper presented at the Alabama Psychological Association Annual Meeting, Birmingham, AL.

The research being reported in this paper was an effort by Division No. 6 (Aviation) of the Human Resources Research Office, to describe the ways in which ineffective aviators cope with combat stress. It was thought that by focusing attention on the behavior of men judged ineffective in combat, we could begin developing measures of overall aviation combat effectiveness. In designing a preliminary study of this kind, we chose a methodology that provided rich and detailed information of the combat environment of Vietnam and aviators' reactions to it.

Quebe, J. C. (1985). *The effects of the flight screening program on attrition in undergraduate pilot training*. Paper presented at the 27th Annual Military Testing Association Conference, San Diego, CA.

Air Force commissioned officer and Officer Training School (OTS) pilot training candidates who do not have a Private Pilot's License are required to complete a Flight Screening Program (FSP). FSP is a 14-hour flying program in the T-41 (Cessna 172). All student sorties are graded by the Instructor Pilot (IP). Students performing especially poorly may be eliminated before completion of the program. After 12 flying hours, students are administered Final Evaluation Flight covering the basic flying skills taught. Students failing this evaluation may repeat it one time. Students achieving a satisfactory Final Evaluation Flight grade proceed to Undergraduate Pilot Training (UPT). All other students are eliminated from the pilot training program for flying training deficiency (FTD). Thus, the program acts as a screen for entry to WT.

Rabin, J. (1996). Correction of subtle refractive error in aviators. *Aviation, Space, and Environmental Medicine, 67*(2), 161-164.

Optimal visual acuity is a requirement for piloting aircraft in military and civilian

settings. While acuity can be corrected with glasses, spectacle wear can limit or even prohibit use of certain devices such as night vision goggles, helmet mounted displays, and/or chemical protective masks. Although current Army policy is directed toward selection of pilots who do not require spectacle correction for acceptable vision, refractive error can become manifest over time, making optical correction necessary. In such cases, contact lenses have been used quite successfully. Another approach is to neglect small amounts of refractive error, provided that vision is at least 20/20 without correction. This report describes visual findings in an aviator who was fitted with a contact lens to correct moderate astigmatism in one eye, while the other eye, with lesser refractive error, was left uncorrected. Advanced methods of testing visual resolution, including high and low contrast visual acuity and small letter contrast sensitivity, were used to compare vision achieved with full spectacle correction to that attained with the habitual, contact lens correction. Although the patient was pleased with his habitual correction, vision was significantly better with full spectacle correction, particularly on the small letter contrast test. Implications of these findings are considered.

Rankin, W. C., & McDaniel, W. C. (1981). *Aviation training task proficiency: A probabilistic approach*. Paper presented at the 23rd Annual Military Testing Association Conference, Arlington, VA.

Determination of the proficient performance of aircraft flying tasks continues to be a subjective judgment made by instructor pilots. Current practice in training squadrons consists of "flights" during which a subset of tasks from the training syllabus are performed a varying number of times by the pilot trainee at the discretion of the instructor pilots. During or shortly after each flight, the instructor pilot "grades" the pilot trainee on the tasks performed using a standard scale but also employing his own personal criteria. While instructors differ in their personal rating bias (hard-easy), they attempt to grade in terms of "average performance at this stage of training." It is usual for the pilot trainee to be exposed to several different instructor pilots. After a specified minimum number of flights, and a recommendation by an instructor pilot, the pilot trainee is scheduled for a final "check flight. His performance on selected tasks is graded by an instructor pilot acting in the independent role of "check pilot." Should the pilot trainee not perform the flight consonant with the standards of performance expected of him by the "check pilot," he is rescheduled for additional "check flights" until he is deemed proficient.

Rauch, M. (1980). *Development of selection simulators in the German military aviation psychology*. Paper presented at the 22ndAnnual Military Testing Association Meeting, Toronto, ON, Canada.

Ray, H., Brueckel, J. S., & Drucker, A. J. (1954). Selection of Army and Air Force Reserve Officer Training Corps students. Washington, DC: The Adjutant General's Office.

Raymond. (1998). Airline Pilot Selection Working Group. *Aviation, Space, and Environmental Medicine, 69*(12).

Razran, G. H. S., & Brown, H. C. (1941). Aviation. *Psychological Bulletin, 38*(6), 322-330.

As a review of the existing knowledge of the psychology of aviation the present paper has a number of limitations. First, it does not include the significant research that has been done in this country in the last year and a half under the auspices of the Committee on Selection and

Training of Aircraft Pilots of the National Research Council and the Civil Aeronautics Authority. Secondly, there is good reason to believe that some important work, particularly in Germany and Russia, is not being published. Thirdly, much of the Russian published material, a considerable amount of the Italian, and even some in the more accessible languages could not be examined in time for the present paper. Nevertheless, the writers have in their possession 626 abstracted references that bear upon the psychology of aviation, and 92 of these titles have been selected for mention here.

Re Vley, D. G. E. (1917). *How to Fly (The Flyer's Manual): A Practical Course of Training in Aviation*. San Francisco: Paul Elder and Company.

Read, W. R. (2003). A pilot encounters the enemy, Western Front, August 1914. In J. E. Lewis (Ed.), *The Mammoth Book of Eyewitness World War I* (pp. 37-38). New York: Carroll & Graf.

Ree, M. (2003). Making scores equivalent for TBAS and BAT: Operational Technologies.

Ree, M. (2003). Test of Basic Aviation Skills (TBAS) incremental validity beyond Air Force Officer Qualifying Test pilot composite for predicting pilot criteria. San Antonio, TX: Operational Technologies Corporation.

Ree, M. J. (1976). Effects of item-option weighting on the reliability and validity of the AFOQT for pilot selection. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Ree, M. J. (2003). Test of Basic Aviation Skills (TBAS): Scoring the tests and compliance of the tests with the standards of the American Psychological Association. San Antonio, TX: Operational Technologies Corporation.

Ree, M. J., Carretta, T., & Earles, J. A. (1999). Salvaging construct equivalence through equating. Wright-Patterson Air Force Base, TX: U.S. Air Force Research Laboratory.

Ree, M. J., & Carretta, T. R. (1992). The correlation of cognitive and psychomotor tests. Brooks Air Force Base, TX: Armstrong Laboratory.

A paper-and-pencil multiple-aptitude test battery and a computer-based psychomotor test battery were administered to a sample of 354 Air Force recruits . The tests of the multiple-aptitude battery were used estimate psychometric g and to predict the psychomotor tests. The multiple correlation of the multiple-aptitude tests and each psychomotor test as a criterion was S0, corrected for range restriction . The average correlation of a psychomotor tests and psychometric g, corrected for range restriction and unreliability , was .73. The multiple-aptitude tests and the psychomotor tests were correlated and subjected to a principal components analysis. The average saturations of the psychomotor and multiple-aptitude tests were .76 and .87, respectively . Confirmatory factor analyses disclosed hierarchical general cognitive and general psychomotor factors, two lower order multiple-aptitude test factors and three lower order psychomotor test factors.

Ree, M. J., & Carretta, T. R. (1994). The correlation of general cognitive ability and psychomotor tracking tests. *International Journal of Aviation Psychology, 2*(4), 209-216.

Ree, M. J., & Carretta, T. R. (1996). Central Role of g in Military Pilot Selection. *International Journal of Aviation Psychology, 6*(2), 111-123.

Examines the role of general cognitive ability (g) in the selection of military pilots. Presentation of the brief history of the use of G in pilot selection; Measurement of g; Awareness of the prominence of g in job performance.1 Examines the role of general cognitive ability (g) in the selection of military pilots. Presentation of the brief history of the use of G in pilot selection; Measurement of g; Awareness of the prominence of g in job performance.

Ree, M. J., & Carretta, T. R. (1997). What makes an aptitude test valid? In R. F. Dillion (Ed.), *Handbook on Testing* (pp. 65-81). Westport, CT: Greenwood Press.

Ree, M. J., & Carretta, T. R. (1998). Computerized testing in the United States Air Force. *International Journal of Selection and Assessment, 6*(2), 82-106.

Ree, M. J., & Carretta, T. R. (1998). Interchangeability of Verbal and Quantitative Scores for Personnel Selection: An Example. Brooks Air Force Base, TX: Air Force Research Laboratory.

Ree, M. J., Carretta, T. R., & Teachout, M. S. (1995). Role of ability and prior job knowledge in complex training performance. *Journal of Applied Psychology, 80*(6), 721-730.

A causal model of the role of general cognitive ability and prior job knowledge in subsequent job-knowledge acquisition and work-sample performance during training as developed. Participants were 3,428 U.S. Air Force officers in pilot training. The measures of ability and prior job knowledge came from the Air Force Officer Qualifying Test. The measures of job knowledge acquired during training were derived from classroom grades. Work-sample measures came from check flight ratings. The causal model showed that ability directly influenced the acquisition of job knowledge. General cognitive ability influenced work samples through job knowledge. Prior job knowledge had almost no influence on subsequent job knowledge but directly influenced the early work sample. Early training job knowledge influenced subsequent job knowledge and work-sample performance. Finally, early work-sample performance strongly influenced subsequent work-sample performance.

Ree, M. J., & Earles, J. A. (1990). Differential validity of a differential aptitude test. Brooks Air Force Base, TX: Air Force Human Resource Laboratory.

Two studies were conducted to examine the role of general and specific ability in predicting performance in military. technical training. The first was a principal components analysis of the Armed Services Vocational Aptitude Battery (ASVAB); the second was a series of regression analyses using principal component scores derived from test scores as predictors and final school grades from Air Force technical training as the criterion. In the first study, 10 principal components were derived using a nation-wide representative sample of American youth. Weights derived from this analysis were used to compute principal component scores for over 78,000 subjects in Air Force technical training in 89 jobs. The first principal component was a general ability factor (g). Some specific ability components were also interpreted. The

subjects for the second study were approximately 78,000 airmen who had taken parallel forms of the ASVAB and completed technical training. Using Final School Grade as the criterion, multiple regressions were computed to determine if g was a potent predictor for all jobs and if predictive accuracy would increase if other principal components, measures of specific abilities, were added to the prediction. The regressions were computed from both uncorrected and corrected correlation matrices to properly estimate the R2 values. For each of. the 89 jobs, the first principal component, g, was the most potent predictor, and for i,9 of the jobs, additional principal components increased the coefficient of multiple correlation. The magnitude of the increase in R2 was estimated to be about .022 on average. Although this may seem small, practical benefits could be realized when applied to large groups of individuals such as applicants for military service.

Reece, R. H. (1919). *Night Bombing With the Bedouins*. Boston: Houghton Mifflin Co.

Regan, J. E. (1982). *Short-term memory and dual task performance*. Paper presented at the 26th Annual Meeting of the Human Factors Society.

The concept of short-term memory as a limited capacity structure is embedded within information processing approaches in psychology. As a consequence, short-term memory tasks have been employed as attention loading devices in studies of dual task performance (Logan, 1979). The assumption behind such studies is that the memory task will load the information processing system and will usurp processing capacity and/or space in the central structure. Performance on the non-memory task is examined to see if processing stages of that task draw on the same capacity or space as the memory task. This paper considers two hypotheses about how short-term memory might interact with another task in a dual task situation. When two tasks are combined, the activity of controlling and organizing performance on both tasks simultaneously may compete with either task for a resource, be that resource space in a central mechanism, general processing capacity, or some task specific resource. If there is some special relationship between short-term memory and control, especially if there is an identity relationship between short term and a central controlling mechanism, then short-term memory performance should show a decrement in a dual task situation. Even if short-term memory does not have any particular identity with a controlling mechanism, but both tasks draw on some common resource(s), then a tradeoff between the two tasks in allocation of resources is possible, and could be reflected in performance.

Reinhart, P. M. (1998). *Determinants of Flight Training Performance: Naval Academy Classes of 1995 and 1996.* MS, Naval Postgraduate School, Monterey, CA.

Reis, P. M. (2000). *Determinants of Flight Training Performance: An Analysis of the Impact of Undergraduate Academic Background.* MS, Naval Postgraduate School, Monterey, CA.

Retzlaff, P., Callister, J., & King, R. (1999). Clinical procedures for the neuropsychological evaluation of U.S. Air Force pilots. *Military Medicine, 164*, 1-6.

Retzlaff, P. D., & Callister, J. D. (2004). *Construct validity of the Armstrong Laboratory Aviation Personality Survey*. Paper presented at the ASMA.

Retzlaff, P. D., Callister, J. D., & King, R. E. (1996). The computerized neuropsychological evaluation of US Air Force pilots: Clinical procedures and data-based decisions: Armstrong Laboratory.

Retzlaff, P. D., Callister, J. D., & King, R. E. (1997). The Armstrong Laboratory aviation Personality Survey (ALAPS): Norming and cross-validation. Brooks Air Force Base, TX: Aerospace Medicine Directorate.

Retzlaff, P. D., & Gibertini, M. (1987). Air Force Pilot Personality: Hard Data on the 'Right Stuff". *Multivariate Behavioral Research, 22*(4), 383.

Retzlaff, P. D., & Gibertini, M. (1998). Objective psychological testing of U.S. Air Force officers in pilot training. *Aviation, Space, and Environmental Medicine, 59*, 661-663.

The authors reviewed the literature pertaining to the use of psychological testing with Air Force pilots and conclude that many of the instruments that have been used are not psychometrically sound and were used in an inappropriate manner. For example, they point out that the often used Minnesota Multiphasic Personality Inventory (MMPI) was developed over 40 years ago and normed on psychiatric patients. They advocate the use of three tests that they believe adequately measure a broad range of cognitive, personality and psychopathological domains. The first of these tests is the Multidimensional Aptitude Battery (MAB) which is a test of intellectual ability based largely on the WAIS-R. Verbal components include information comprehension, arithmetic, similarities and vocabulary. Performance measures include digit symbol coding, picture completion, spatial thinking, picture arrangement and object assembly. The Personality Research Form (PRF; Form E) measures normal personality characteristics and has 352 true-false items, organized into 21 scales. The following are some of the traits measured: achievement, aggression, autonomy, dominance, harm avoidance, impulsivity and social recognition. The Millon Clinical Multiaxial Inventory (MCMI) is a 20-scale instrument designed to measure dimensions associated with psychiatric diagnoses. The MCMI assesses eight basic personality patterns, three pathological personality patterns and nine clinical syndromes. The sample used in this study consisted of 350 white males entering Undergraduate Pilot Training (UPT). For the MAB, the subjects had an average full scale IQ of 120, with an average verbal IQ of 117 and an average performance score of 121. Most subjects scored above the MAB normative sample. For the PRF, the pilots scored higher than college students on affiliation, cognitive structure, dominance and social desirability. They scored lower than college students on abasement, autonomy, harm avoidance and understanding. The authors pointed out that this could be a result of differences in age, education, or other moderators between student pilots and college students. The MCMI pointed to histrionic and narcissistic patterns personality in the student pilots. The authors note that this is in line with the lay perception of the pilot as highly sociable and having strong self esteem.

Retzlaff, P. D., King, R. E., & Callister, J. D. (1995). USAF pilot training completion and retention: A ten year follow-up on psychological testing. In A. Laboratory (Ed.). Brooks AFB, TX: U.S. Air Force Armstrong Laboratory.

Retzlaff, P. D., King, R. E., Callister, J. D., Orme, D. R., & Marsh, R. W. (2002). The Armstrong

Laboratory Aviation Personality Survey: Development, Norming, and validation. *Military Medicine, 167*(12), 1026-1032.

This work describes the development of a new psychological test for aviators. The Armstrong Laboratory Aviation Personality Survey was developed through the integration of clinical theory, psychometric methods, and empirical testing. It is currently given to all incoming U.S. Air Force pilot candidates. Using a sample of 6,047 student pilots, a thorough test development plan was accomplished. The 15 final test scales assess personality, psychopathology, and crew interaction styles. The scales have normative data and are demonstrated to be reliable and valid. The Armstrong Laboratory Aviation Personality Survey is recommended for use in the aviation community for both clinical and research purposes. Future research is recommended and needed in the areas of training, airframe, and special duty selection. Additional clinical work is indicated in the areas of psychiatric, psychological, and aeromedical evaluations.

Retzlaff, P. D., King, R. E., McGlohn, S. E., & Callister, J. D. (1996). The Development of the Armstrong Laboratory Aviation Personality Survey (ALAPS). Brooks AFB, TX: Armstrong Laboratory.

Personality Survey (ALAPS). Brooks AFB, TX, Armstrong Laboratory. This work describes the development of a new psychological test for aviators. The Armstrong Laboratory Aviation Personality Survey (ALPS) was developed through the integration of clinical theory, psychometric methods, and empirical testing. Using a sample of 200 student pilots, a thorough test development plan was accomplished. The 15 final test scales cover personality, psychopathology, and crew interaction styles. The scales have normative data and are demonstrated to be reliable and valid. Additional validity work is suggested to further improve the test.

Reynolds, R. (2003). So who do you think you are? *Civil Aviation Training,* 12-14.

Ricciuti, H. N., & French, J. W. (1951). Development of personality tests for Naval officer selection: I. Analysis of U.S. Naval Academy criterion of aptitude for service. Princeton, NJ: Educational Testing Service.

Ricciuti, H. N., & French, J. W. (1952). Development of personality tests for Naval officers selection: II. Validation of experimental tests of U.S. Naval Academy. Princeton, NJ: Educational Testing Service.

Ricketson, D. S., & Sanders, M. G. (1983). High-Risk Aviator Study. Ft Rucker, AL: U.S. Army Safety Center.

Rippon, T. S., and Manuel, E.G. (1918). The essential characteristics of successful and unsuccessful aviators. *Lancet*, 411-415.

Rippon, T. S., & Manuel, E. G. (1918). Report on the essential characteristics of successful and unsuccessful aviators. *Lancet*(September 28), 411-415.

Ritter, R. M. (1958). Adaptability screening of flying personnel: USAF School of Aviation

Medicine.

Roach, B. W. (1983). *Monetary value of pilot selection using the AFOQT*. Paper presented at the 25th Annual Military Testing Association Conference, Gulf Shores, AL.

Paper-and-pencil tests have been used by the Air Force to aid in the selection of candidates for pilot training for more than forty years. The Aircrew Classification Battery (ACB) was first developed for this purpose by the Aviation Psychology Program during World War II. During the early stages of the development of the ACB, selection for pilot training was not based on predictor scores and most early classes had attrition rates of 35 to 75 percent. Thus,. initial biserial correlations in the .40's and .50's were reported using success in flight training as the criterion (Flanagan, 1948). Selection into Undergraduate Pilot Training (UPT) is now based on Pilot composite scores on the Air Force Officer Qualifying Test (AFOQT). Only applicants who have successfully passed a rigorous physical examination are considered. Additionally, all UPT cadets must be graduates of a four-year college program prior to entry into UPT. Since highly restricted applicants are rank-ordered for selection based on AFOQT performance and since current UPT attrition rates are only about 15 percent, the biserial correlation has dropped to the present value of .16.

Roach, B. W., & Rogers, D. L. (1983). *Sex as a moderator variable in predicting OTS attrition*. Paper presented at the 25th Annual Military Testing Association Conference, Gulf Shores, AL.

Roberts, H. E., & Skinner, J. (1996). Gender and Racial Equity of the Air Force Officer Qualifying Test in Officer Training School Selection Decisions. *Military Psychology, 8*(2), 95-113.

Using Cleary's (1968) model of test bias, relations between aptitude scores and training performance were evaluated for race and gender subgroups of military officer candidates. Regression analyses revealed level bias with minority performance being overpredicted by a small and constant amount at all aptitude levels, suggesting that test usage results in higher selection rates for female and Black cadets. These results are consistent with the literature in education, industry, and prior studies conducted in the military.

Roberts, L. R. (2006). Ground Truth: The Implications of Joint Interdependence for Air and Ground Operations (pp. 100). Maxwell Air Force Base, AL: Air University Center for Strategy and Technology.

Joint interdependence grows out of the growing reliance of the Army on the Air Force as it becomes more agile and sheds some of its organic fires. Therefore, this research paper only addresses those areas where air and ground operations merge, on the battlefield. There are four questions addressed herein: What are the implications of joint interdependence? What are the doctrinal friction points? Where is the potential for operational seams? What might be the options for a way ahead? Organizing the services to become more interdependent makes sense operationally and strategically. Yet, experiences in Afghanistan and Iraq demonstrate that the services have much to accomplish to institutionalize joint interdependence despite the spirit of cooperation that now exists between the air and land services in both areas of operations. The simultaneous ground operations of the US Army‘s V Corps and the US Marine Corps‘ I MEF during Operation Iraqi Freedom provides a unique opportunity to evaluate the issues of joint

interdependence and propose potential solutions towards creating mutually enabling air and ground operations. This recent experience combined with the historical accounts of past air-ground cooperation provides some of the answers to the questions posed above and is also indicative of the difficulty in actually institutionalizing the organizational, training, and doctrinal changes necessary to make an interdependent land and air force. This will be hard work. Understanding the implications of creating a truly interdependent force capable of withstanding the pressures of the next inter-war period is the first step.

Robertson, I. T., & Smith, M. (2001). Personnel selection. *Journal of Occupational and Organizational Psychology, 74*, 441-472.

The main elements in the design and validation of personnel selection procedures have been in place for many years. The role of job analysis, contemporary models of work performance and criteria are reviewed critically. After identifying some important issues and reviewing research work on attracting applicants, including applicant perceptions of personnel selection processes, the research on major personnel selection methods is reviewed. Recent work on cognitive ability has confirmed the good criterion- related validity, but problems of adverse impact remain. Work on personality is progressing beyond studies designed simply to explore the criterion-related validity of personality. Interview and assessment centre research is reviewed, and recent studies indicating the key constructs measured by both are discussed. In both cases, one of the key constructs measured seems to be generally cognitive ability. Biodata validity and the processes used to develop biodata instruments are also critically reviewed. The article concludes with a critical evaluation of the processes for obtaining validity evidence (primarily from meta-analyses) and the limitations of the current state of the art. Speculative future prospects are briefly reviewed.

Robertson, K. D., & Castle, C. (1996). Complex Visual Task (CVT): Software upgrade. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Robins, B. S. (2000). *American eagles: Forming the Lafayette Escadrille, RAF Eagles and Flying Tigers.* Master of Arts, University of Nebraska.

Robinson, L., Gainer, C., & Kahn, O. (1972). Personnel subsystem test and evaluation plan. Santa Monica, CA: Lear Siegler Inc.

Roff, M. (1953). The pilot candidate selection research program, V: A factorial study of the motor aptitudes area. Lackland Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Roff, M. F. (1948). Psychological research at the AAF School of Aviation Medicine. *Journal of Aviation Medicine, 19*, 20-23.

Roff, M. F. (1951). Personnel selection and classification procedures: Spatial tests (Project No. 21-29-112). Randolph Field, TX: USAF School of Aviation Medicine.

Rogers, D. A., Covington, E. C., & Jensen, R. S. (1999). Response predispositions and piloting safety. *International Journal of Aviation Psychology, 9*(1), 73-90.

Rogers, D. L. (1983). *Development of the Air Force officer screening composites*. Paper presented at the 25th Annual Military Testing Association Conference, Gulf Shores, AL.

Rogers, D. L. (1984). *The effectiveness of biographical inventories in predicting success in OTS*. Paper presented at the 9th Symposium on Psychology in the Department of Defense, U.S. Air Force Academy, Colorado Springs, Co.

Rogers, D. L. (1985). Screening composites for Air Force officers. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Rogers, D. L., Roach, B. W., & Short, L. O. (1986). Mental ability testing in the selection of Air Force Officers: A brief historical overview. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

This paper addresses the use of officer selection and classification tests from the early 1940s to 1986, with emphasis on the evolution of the Air Force Officer Qualifying Test (AFOQT). It is intended as a readable historical overview of officer testing, not as a detailed technical document. The paper emphasizes AFOQT test forms and content as they relate to each other, up to and including the present operational version, Form 0.

Rogers, D. L., Roach, B. W., & Wegner, T. G. (1986). Air Force Officer Qualifying Test Form 0: Development and standardization. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Rogers, M. S., & Shure, G. H. (1962). Personality factor stability for three ability levels. Santa Monica, CA: System Development Corp.

Rogers, O. E. (1956). Analysis of basic training stage grades for multiengine and single-engine aviators. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Roscoe, S. N. (1993). An aid in the selection process - WOMBAT. *Civil Aviation Training, 4*(2), 48-51.

Roscoe, S. N. (1997). The Adolescence of Engineering Psychology. *Human Factors History Monograph Series, Volume 1*, 1-9.

This retrospective account of the emergence of engineering psychologists – in the military, in academia, in the aviation industry, in troubleshooting system problems, in consulting, and in course setting for civil and military agencies – is based largely on my recollections and many years of correspondence with others of similar vintage or older.

Roscoe, S. N., & Corl, L. (1987). *Wondrous original method for basic airmanship testing*. Paper presented at the 4th International Symposium on Aviation Psychology, Columbus, OH.

Roscoe, S. N., Corl, L., & LaRoche, J. (1997). *Predicting Human Performance*. Pierrefonds QC: Helio Press, Inc.

Roscoe, S. N., & Williams, A. C. (1980). *Aviation psychology* (1st ed.). Ames: Iowa State

University Press.

Roscoe, S. N., & Williges, B. H. (1971). *Three lessons in aviation research*. Urbana: Engineering Publications Office, College of Engineering, University of Illinois at Urbana-Champaign.

Rosenberg, N., & Izard, C.E. (1953). Vocational interests of Naval aviation cadets: Preliminary findings. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Rosenberg, N. (1954). Time to complete naval air training as an additional criterion of success. Pensacola, FL: Naval School of Aviation Medicine.

Rosenberg, N., & Izard, C. E. (1954). Vocational interests of Naval aviation cadets. *Journal of Applied Psychology, 38*, 354-358.

Rosenberg, N., Martinek, H., & Anderson, A. A. (1959). Development of a provisional battery for selecting Army helicopter pilot trainees. Washington, DC: The Adjutant General's Office.

Rosenberg, N., Skordahl, D. M., & Anderson, A. A. (1961). Development of experimental selectors for Army helicopter pilot trainees: Personality constructs. Washington, DC: The Adjutant General's Research and Development Command.

Rosenberg, N., Skordahl, D. M., & Kaplan, H. (1961). Validation of Army Fixed Wing Aptitude Battery against success in ROTC flight training. Washington, DC: The Adjutant General's Research and Development Command.

Rosenberg, N., Skordahl, D. M., & Kaplan, H. (1961). Validation of Army Fixed-Wing Aptitude Battery against success in Army flight training. Washington, DC: U. S. Army Adjutant General's Research and Development Command.

The Army Fixed-Wing Aptitude Battery (AFWAB) has been used operationally since 1956 to select trainees for the Army Fixed-Wing Flight Training Program. The present study was undertaken to evaluate the battery for use in selecting trainees for the ROTC Flight Training Program. Additional purposes were to provide information which could be used to establish cutting scores appropriate to the Army's ROTC flight training requirements for a given year and to study the effect of weighting the tests by a multiple correlation procedure. The battery was administered to samples of ROTC Flight Training Program applicants representative of ROTC classes of academic years 1956-57, 1957-58, and 1958-59 (total N = 1245). The AFWAB was found to have useful validity against a criterion of successful completion of the Flight Training Program (r = .33). All component tests were found to contribute to the selective efficiency of the battery (correlation coefficients ranged from .20 to .24, intercorrelation coefficients from .11 to .52). The unit-weighted composite proved to be as effective as the administratively more cumbersome optimally weighted score.

Rossmeissl, P. G., & Dohme, J. A. (1982). *Using rating scales to determine aptitude requirements of Army systems*. Paper presented at the 24th Annual Military Testing

Association Conference, San Antonio, TX.

Rotch, A. L. (1900). *Sounding the Ocean of Air*. London: Society for Promoting Christian Knowledge.

Rotch, A. L. (1909). *The Conquest of the Air or the Advent of Aerial Navigation*. New York: Moffat, Yard and Company.

Roth, J. T. (1980). Continuation of data collection on causes of attrition in Initial Entry Rotary Wing training. (pp. 53). Valencia, PA: Applied Science Associates, Inc.

Rumsey, M. G., Vicino, F., & Kyllonen, P. (1993). *Joint Service Plan for Selection and Classification Research: 1993 - 2003*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

Downsizing, declining military budgets, and changing world conditions have combined to create a growing need for the military services to coordinate their research efforts. Responding to this need, coordinate manpower, they reached an agreement in 1990 to personnel and training research through a committee known as TAPSTEM. Selection and classification was identified as a major component of manpower and personnel research, and a Selection and Classification Subcommittee was established to assist the Manpower and Personnel working group in addressing this area. This year, the subcommittee was charged with developing a long-range joint service selection and classification research plan. This paper describes this plan.

Rumsey, M. G., Walker, C. B., & Harris, J. H. (Eds.). (1994). *Personnel Selection and Classification*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Samet, M. G., Geiselman, R. E., Zajaczkowski, F., & Marshall-Miles, J. (1986). Complex Cognitive Assessment Battery (CCAB): Test descriptions. Los Angeles, CA: Analytical Assessments Corp.

Sanders, J. H., Valentine, L. D., & McGrevy, D. F. (1971). The development of equipment for psychomotor assessment. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

The purpose of the work was to develop a highly flexible psychomotor testing system capable of reproducing the psychological task structure of two electromechanical tests used earlier in Air Force pilot selection programs. These were the SAM Complex Coordination Test and the SAM Two-Hand Coordination Test. The work was conducted in two phases, the first of which resulted in the definition, design, assembly, and testing of the psychomotor testing system. The second phase involved the testing of 120 Air Force pilot candidates and analysis of the data. The system developed to implement these tests consists of two test stations (expandable to eight) and a test control unit. Test control station functions are performed with a PDP-8/L digital computer which can generate graphical, alphanumeric, or point displays on a direct-view storage tube. The feasibility of this psychomotor testing system was demonstrated and found to be highly flexible and efficient, with a capability for conducting test sessions under automated conditions.

Sanders, M. G., & Hoffman, M. A. (1975). Personality aspects of involvement in pilot-error

accidents. *Aviation, Space, and Environmental Medicine, 46*(2), 186-190.

The authors examined the utility of a decision-making task and various personality variables for discriminating between pilots who had been involved in an accident and those who had not. Subjects were 51 volunteer military aviators with ranks ranging from Chief Warrant Officer-2 to Lieutenant Colonel. Prior accident involvement was determined through an investigation of the United States Army Agency for Aviation Safety (USAAAVS) accident records. Each aviator listed as a causal factor in at least one aviation accident (either major, minor, or incident) was classified as pilot-error accident involved (PEAI), otherwise, they were classified as pilot-error accident free (PEAF). Several measures were administered to all of these aviators. The first was the 16 PF (Form A), a personality inventory, which consists of 16 primary factors and four secondary factors. The second inventory was the Mehrabian Achievement Scale which provides an indication of need for achievement or desire to attain success. A decision-making task was also administered which involved having the subject decide when to leave a light on or turn it off, based on a set of rules. Subjects' scores were the means of each of the various instruments taken over several different trials. The first analysis included the measures from the 16 PF and the N-Ach score from the Mehrabian. Three of the 21 scores discriminated between the PEM and the PEAF aviators: (1) Group Dependent vs. Self Sufficient; (2) Practical vs. Imaginative; and (3) Forthright vs. Shrewd. These three scores correctly classify 86 percent of the sample into either the PEAT or the PEAF groups. The second stepwise discriminant analysis included the scores from the decision-making task. Again, none of these scores successfully discriminated between the two groups of aviators. This study was cross-validated in a later paper (Sanders, Hoffmann, & Neese, 1976) and the results did not replicate.

Sanders, M. G., Hoffmann, M. A., & Neese, T. A. (1976). A Cross-validation study of the personality aspects of involvement in pilot-error accidents. *Aviation, Space, and Environmental Medicine, 47*(2), 177-179.

The authors conducted a cross-validation study in an attempt to replicate the results obtained by Sanders and Hoffman (1975). The sample consisted of 66 military aviators. Once again the 16 PF (Form A) was administered. Pilots were classified into one of two groups, either pilot-error accident involved (PEAI) or pilot-error accident free (PEAF) based on United States Army Agency for Aviation Safety (USAAAVS) accident records. The stepwise discriminant analysis did not discriminate between PEAI and PEAF aviators. A second stepwise discriminant analysis was performed using age, total military flight hours and years of flight status. None of these variables discriminated between PEAF and PEN pilots. The authors conclude that individual differences in personality characteristics of aviators prevented the identification of personality traits associated with the PEAI and the PEAF groups.

Sanders, M. G., Hofmann, M. A., Hunt, P. D., & Snow, A. C. (1974). Personality aspects of pilot-error accident involvement. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Sanders, M. G., Hofmann, M. A., & Neese, T. A. (1975). A cross validation study of the personality aspects of involvement in pilot-error accidents. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Santos-Dumont, A. (1904). *My Airships*. New York: The Century Co.

Schepers, J. M. (1962). A components analysis of a complex psychomotor learning task. *Psychologia Africana, 9*, 294-329.

Schoenberger, R. W., Wherry, R. J., & Berkshire, J. R. (1963). Predicting success in aviation training. Naval Air Station Pensacola, FL: Naval School of Aviation Medicine.

School of Aviation Medicine Staff. (1944). Research program on psychomotor tests in the Army Air Forces. *Psychological Bulletin, 41*, 307-321.

Schreiber, B. T., Lyon, D. R., Martin, E. L., & Confer, H. A. (2002). Impact of prior flight experience on learning predator UAV operator skills. Mesa, AZ: Air Force Research Laboratory.

Unmanned/uninhabited aerial vehicles (UAVs) are an increasingly important part of military operations throughout the world. However there is no consensus about who should fly these aircraft . The United States Air Force (USAF) Corona South four-star general officer Summit in 1997 resulted in tasking the Air Force Research Laboratory to conduct a study to compare the speed and accuracy with which various groups of pilots could learn to fly the RQ-1 A Predator UAV. This study primarily addressed stick-and- rudder skills ; we did not measure such operationally relevant factors as communication skills, command experience, or knowledge of combat operations . Seven groups of military and civilian pilots, varying in amount and kind of flying experience, completed a series of multimedia tutorials on principles of flight and procedures for operating the Predator, then flew a high-fidelity RQ-IA simulator. Each participant flew basic maneuvers and landings (including difficult crosswind landings) until a very high standard of aircraft control performance was achieved, then flew 30 reconnaissance scenarios. During this time, detailed measures of performance were continuously and automatically recorded . The results show that, though Predator pilots performed best (and nonpilots performed worst), USAF T-38 graduates and civilian pilots with single-engine instrument training performed nearly as well as a group of highly experienced military pilots assigned (but not yet trained) to fly Predator. A possible explanation for the relatively good performance of the T-38 and civilian instrument pilots is that there may be advantages to recent experience flying aircraft that have handling characteristics that are similar to the Predator.

Schwarts, M., & Lowe, B. H. (1958). Gymnastics grades as predictors of attrition to flight training. Pensacola, FL: Naval School of Aviation Medicine.

Schweiker, R. F. (1959). Stability of interest measures and their validation for selection and classification. Lackland Air Force Base, TX: Wright Air Development Center.

Schweiker, R. F., & Curran, R. J. (1959). Variables contributing to regular officer procurement panel scores. Lackland Air Force Base, TX: Wright Air Development Center.

Schweitzer, J. J. (1976). Reducing attrition rates and training costs in undergraduate pilot training through improved screening and motivational methods. Maxwell Air Force Base, AL: Air University.

Scribner, D. R. (1998). Skill level 10 operations and unit maintenance skills: An examination of tactical unmanned vehicle (TUV) soldier-marine capabilities (pp. 45). Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.

An analysis was performed to identify specific skills required to successfully perform operations and unit maintenance tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a skill level of IO have those skills. This analysis was performed by the Human Research and Engineering Directorate of the U.S. Army Research Laboratory at the behest of the Program Manager Unmanned Ground Vehicles/Systems. Military occupational specialties examined included U.S. Army infantryman (lIB), cavalry scout (19D), and the Marine Corps rifleman (0300). System-required operations and unit maintenance functions and tasks were identified. Soldier-marine operations and unit maintenance skills were compared to these tasks. Results of the analysis show that of 209 operations skills required by the TUV system, 82 were mismatched because of a higher skills requirement, untrained system-specific skills, or a combination of both. Additionally, all 25 unit maintenance tasks were identified as requiring system-specific training.

Scriven, G. P. (1915). *The service of information: United States Army*. (Circular No 8). Washington, DC: U.S. Government Printing Office.

It has long been the belief of the writer of these notes that the functions of certain branches of the service auxiliary to the line in the United States army are not in general well understood even by people who are interested in military affairs. The reasons for this are, no doubt, in part due to the fact that the functions of these auxiliaries are many and varied, and are not outlined in available form or even clearly defined except in the brief and general statements of laws, regulations, or orders affecting the service. This lack of knowledge seems to be especially true of the corps with which the writer has long had the honor to serve, the name of which gives no indication what-ever of its functions, scope, and value to the army. It is thought, therefore, that an outline of the duties and field of usefulness of the signal corps of the army may be of value to those interested in military affairs, to others upon whom the army must depend for its maintenance, and to officers and men of the national guard who will be called upon to perform the duties of signalmen. To instructors and students at military schools, to officers of the regular army who may be called by detail or by accident of service to construct and maintain lines of information, and to the great mass of the volunteers if called to the defense of the country, these notes may also be of interest and use. For these reasons they have been prepared. The writer begs to acknowledge his indebtedness to Lieut. Col. Samuel Reber, Maj. Edgar Russel, Capts. Charles S. Wallace, George S. Gibbs, and G. Soulard Turner, of the signal corps, and Mr. William M. Reading, of the signal office, for their assistance in the preparation of these notes.

Seaquist, M. R., Barry, J. R., & Sells, S. B. (1956). Adaptability screening of flying personnel: Life history inquiry approach based on the Personal History and Background Information Questionnaire. Brooks Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Seeley, L. C., Rosen, T., & Stroad, K. (1978). Early development of the Military Aptitude Predictor (MAP). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The Army Research Institute (ARI) was directed by the Deputy Chief of Staff for

Personnel to develop and validate motivational measures to aid in selection of enlisted personnel. The development of the Military Aptitude Predictor (MAP) was begun in 1973 for this purpose. The initial MAP included the trainee's age, education, aptitudes, and civil court convictions (moral waiver) as predictors of military performance, and was intended for use at the Armed Forces Examining and Entrance Stations (AFEES). The 1975 version (MAP-75) was intended for use by recruiters to provide a prediction of Basic Combat Training (BCT) behavior and performance at an earlier point in time, thus saving the Army AFEES transportation and processing costs. In April 1975, the Secretary of the Army directed implementation of the MAP to begin 1 August 1975. This initial testing was conducted in one District Recruiting Command (DRC) in each of the five Recruiting Regions during the period 1 August - 30 September 1975. Its operational use was suspended on 1 October 1975 and, immediately following suspension of testing, ARI conducted interviews in the five DRC's to determine the nature and extent of problems associated with its use.

Seidenman, P. (2000). Committed to regional jets. *Civil Aviation Training,* 36-41.

Seidenman, P. (2001). Blue in the Race. *Civil Aviation Training,* 8-11.

Seidenman, P. (2001). Pacemaker Comair in expansive mode. *Civil Aviation Training,* 20-24.

Seidenman, P. (2001). Wild times at SkyWest. *Civil Aviation Training,* 6-9.

Sekiguchi, C., Umikura, S., Sone, K., & Kume, M. (1994). Psychological evaluation of Japanese astronaut applicants. *Aviation, Space, and Environmental Medicine, 65*(10 Pt 1), 920-924.

In 1991, a new psychological selection procedure was employed during the selection of Japanese Space Station astronauts. It was based on international selection criteria developed by an international psychological/psychiatric working group. A total of 372 individuals--fewer than expected--submitted applications for Space Station astronaut in Japan. Of the applicants, 233 were given several psychological written tests [Anxiety Scale, Performance Test, General Aptitude Test Battery, and Environmental Adjustment Test Battery (EATB)] in Phase I of the selection. Forty-five applicants went on to take the General Aptitude Test Battery (GATB), Human Assessment Method (a group test), a semi-structured psychological interview and an intelligence test in Phase II of the selection. All applicants were found to be highly intelligent. Interestingly, an unexpectedly large number of candidates were disqualified by the newly developed EATB. Assessment of individual functioning in a group (the Human Assessment Method) resulted in no applicant being ranked in either the "qualified with reservation" (QR) or "disqualified" (DQ) category. Much has been learned from this initial application of psychological "select-in" testing, but further efforts are needed to improve both psychological criteria and evaluation methods and to determine their reliability and validity.

Sells, S. A. (1956). Further developments on adaptability screening of flying personnel. *Aviation Medicine, 26*, 35-45.

This was the third progress report on the development of a personality battery to supplement present aircrew selection techniques. The goal of the program was to identify prospective aircrew trainees who were predisposed to difficulties in adapting to the rigors of military flying. Predictor measures included a wide variety of aptitude, personality, perceptual,

attitude and psychomotor variables. Personnel information from Personnel File Form 66 and the 20 1 File concerning rate and extent of promotion, type of assignment, extent of command responsibility and flying duties involved were gathered to use as criteria. Psychologists made adjustment ratings, one of which was a purified pass/fail criterion. The high group included those who graduated from training and were well-adjusted. The low group consisted of pilots who failed training for reasons of poor motivation, excessive emotional reaction, or overt symptoms attributable to stress in the program. The following are the results obtained when correlating the different predictors with the various criteria. The Aviation Interest Key is comprised of 25 items covering the attitudes of parents toward the trainees participation in hazardous sports, a history of motion sickness, prior military flying experience, etc. It yielded correlations of .37 to .41 with the purified pass/fail criterion controlling for pilot stanine. Seven Minnesota Multiphasic Personality Inventory (MMPI) scales (Hs, Pd, Winne, Taylor, Seaquist, D and Hy) correlated from .10 to .40 (mean = .24) with the purified pass/fail criterion measure. The Pilot Opinionaire used an indirect polling approach to assess attitudes toward various aspects of military aviation (and also included an authoritarianism scale). Correlations were found between it and the pass/fail criterion that ranged from .28 for cadets to .I1 for officers. The author also demonstrated that even though aptitude measures were much more highly correlated with the pass/fail criterion (r = .53), they correlated only .13 with information from Form 66 (which involves job performance). Whereas, the correlations of the personality variables remained relatively constant, albeit low (r = -1 1). At this point in time, only four screening tests have been validated against post-training criteria, the Personal Inventory (PI), the Cornell Index (CI), the Cornell Word Form (CWF) and the Sentence Completion (SC) Factor scores. The correlations of these tests with various personnel file form (Form 66) information ranged from -.07 (for Interpersonal Attitudes) to .23 (for Self-Enhancement).

Sells, S. B. (1955). Development of a personality test battery for psychiatric screening of flying personnel. *Aviation Medicine, 25*, 35-45.

The author characterizes the qualifications for jobs in combat aircrews as encompassing three areas: (1) physical qualifications; (2) abilities and aptitudes; and (3) personality factors. He notes that the USAF has developed thorough and effective standards for selection procedures for the first two areas, but not for the third area. This report summarized the progress to date on a large scale developmental project (started in 1949) to update the USAFs use of personality factors in selection. The present research included only pilots. Subjects were administered a wide range of paper and pencil, projective, performance and apparatus tests. Students entering flying school were not told that they could be eliminated based on the results of the test, but they were led to believe that the tests would be used for administrative decisions (i.e., selection). Validation of the tests were in progress (or planned) at the time of this article was written for three stages in the students careers: (1) training; (2) post-training and operational experience; and (3) combat performance (based on data collected in Korea). The results indicated that ratings made by classmates and by instructors during training were superior to psychologists' evaluations in predicting combat performance. However, a significant positive correlation was found between performance ratings in combat and an absence of pathological behavior symptoms in the clinical reports made by a field survey team. Also, pilots with superior adjustment ratings in training and higher pilot stanines tended to have more accidents. At the time this article was written, all studies had been conducted using training level criteria, which relies on a pass/fail criterion. The author advocates using "purified" pass/fail measures. For example, one approach is to classify

the population into more refined administrative categories according to their performance in training. Finally, the author stated that there are three broad, interrelated areas in which efforts should be concentrated: (1) specific motivational structure; (2) character integration; and (3) tolerance of frustration and anxiety.

Sells, S. B. (1955). Development of a personality test battery for psychiatric screening of flying personnel. *Journal of Aviation Medicine, 26*, 35-45.

Sells, S. B., & Barry, J. R. (1953). A research program to develop psychiatric selection of flying personnel I: Theoretical approach and research design. *Journal of Aviation Medicine, 24*, 29-35.

Sells, S. B., & Barry, J. R. (1953). A research program to develop psychiatric selection of flying personnel II: Research progress. *Journal of Aviation Medicine, 24*, 36-47.

Sells, S. B., Trites, D. K., & Parish, H. S. (1957). Correlates of manifest anxiety in beginning pilot trainees. *Journal of Aviation Medicine, 28*, 583-588.

Sells, S. B., Trites, D. K., Templeton, R. C., & Seaquist, M. R. (1958). Adaptability screening of flying personnel: Cross-validation of the Personnel History Blank under field conditions. *Journal of Aviation Medicine, 29*, 683-689.

A field tryout of an experimental test battery for adaptability screening of flying personnel was begun in September, 1956, by the U.S. Air Force School of Aviation Medicine at Lackland Air Force Base, Texas. This battery consisted of seven paper and pencil, machine scored, personality and motivational tests which had been developed and validated in previous research.1-6.10 These tests have been ad ministered, under operational testing conditions to 9,500 students entering pre-flight schools for aircrew training as part of their entrance physical-examination. The Field Testing Laboratory of the Department of Medical Psychology of this school, carried out this project, under the, direction of one of us (R.C,T.).

Senders, J. W. (2007). Response: Is the "Is the UAV control ration the right question?" the right answer? *Ergonomics in Design, 15*, 31.

There are a variety of ongoing attempts to generate unmanned aerial vehicle (UAV) technologies to exploit the advantages that these semiautomated and automated airborne platforms promise to render. (Although we refer specifically to UAVs here, our arguments apply, in principle, to all remote vehicles whatever their medium of operation. The principles themselves also extend to other forms of nontransport-based entities.) With regard to such operations, the collective community is searching for the ratio between operator(s) and vehicle(s) that will prove most efficient and effective.

Serusi, C., & Calanna, P. (2004). *Validity of a Computer-Based Test System and Psychological Assessment in Controlling Flight Training False Positive Rate*. Paper presented at the 46th Annual International Military Testing Association Conference, Brussels, Belgium.

The reduction of military pilot training attrition rates is a central issue for any successful and cost-effective selection procedure. With this object in mind, a validation study was designed using the –Pilot Aptitude Tester" (PILAPT) together with other assessments used by the Italian

Air Force (IAF). The main hypothesis was that the combined use of traditional and computer-based techniques would reduce false positive rates in selecting candidates admitted to flight training.

Shaffer, M. T., Hendy, K. C., & White, L. R. (1988). *An empirically validated task analysis (EVTA) of low level Army helicopter operations*. Paper presented at the 32nd Annual Meeting of the Human Factors Society.

A computer-based Empirically Validated Task Analysis (EVTA) of Canadian Forces light observation helicopter operations was conducted from video records of cockpit activity gathered during flight. The task analysis was performed in order to provide data for function analysis and work-load prediction studies in support of the Canadian Forces Light Helicopter replacement project. Observable behaviors were categorized according to the type of activity involved and communications were analysed for content, agencies involved, and relevance to the crew's task. The results of this study indicate that data gathered from a controlled test environment can differ considerably from those obtained in operational settings and that miniature video cameras can be useful in obtaining information from environments which hitherto may have been inaccessible to all but operational personnel.

Shanahan, F. M., & Kantor, J. E. (1986). Basic navigator battery: An experimental selection composite for undergraduate navigator training. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Shanmugaratnam, S., & Parush, A. (2009). Situation Awareness: A Review of Definitions, Measurements and Predictors, and Implications for Creating a Task-Based Selection Test Battery (pp. 92). Ottawa, ON: Director General Military Personnel Research and Analysis.

The purpose of this document is to provide a critical review of the literature on situation awareness and to determine whether current situation awareness measurement techniques are adequate to be used as a part of personnel selection tests. In order to determine if this is the case, the discussions in this document are centered on (a) providing a working definition of situation awareness; (b) understanding the various situation awareness models; (c) evaluating current situation awareness measurements; (d) identifying key domains where individual differences in situation awareness matter; and (e) identifying correlates of situation awareness levels. It is concluded that the current measurement tools may not be sensitive enough to be used for selection purposes; therefore development of a new, job task based, selection battery is recommended.

Shannon, R. H., & Waag, W. L. (1972). Toward the development of a criterion for fleet effectiveness in the F-4 fighter community. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Shannon, R. H., & Waag, W. L. (1973). Prediction of pilot performance in the F-4 aircraft. *Aerospace Medicine, 45*, 167-170.

Shannon, R. H., & Waag, W. L. (1973). Prediction of pilot performance in the F-4 aircraft. Pensacola, FL: Naval Aerospace Medical Institute, Naval Aerospace Medical Research

Laboratory.

Shenk, F., Watson, T. W., & Hazel, J. T. (1973). Relationship between personality traits and officer performance and retention criteria. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Shephard, A. H. (1950). Losses of skill in performing the standard Mashburn task arising from different levels of learning on the reversed task: Office of Naval Research.

Shipley, B. D. (1979). Learning aptitude, error tolerance, and achievement level as factors of performance in a visual-tracking task. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Shipley, B. D. (1980). Theoretical and empirical foundations of content validity in the selection and management of Army aviator trainees. Fort Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences.

Shipley, B. D. (1983, April, 1983). *Maintenance of level flight in the UH-1 flight simulator as a predictor of success in Army flight training* Technical Report, Fort Rucker, AL.

Shipley, B. D. (1984). *Productivity and difficulty as new criteria for validating aviator selection tests.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting. The US Army Research Institute is conducting research to improve the quality of the Army's aviator selection testing program. The research is motivated by increasing costs of training and by changing aviator ability requirements due to advanced aircraft and modern tactics. This paper describes the development of a new criterion variable to support the testing improvement research.

Shipley, B. D., & Bynum, J. A. (1979). Complexity of performance as an indicator of piloting skill in an instrument flight trainer job-sample test. Fort Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences.

Shoenberger, R. W. (1958). Prediction of advanced training attrition. Pensacola, FL: Naval School of Aviation Medicine.

Shoenberger, R. W. (1963). Personality orientation and success in navel aviation training. Pensacola, FL: Naval School of Aviation Medicine.

Shoenberger, R. W., Wherry, R. J., & Berkshire, J. R. (1963). Predicting success in aviation training. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Shore, C. W., & Gould, R. B. (2003). Developing pilot and navigator/technical composites for the Air Force Officer Qualifying Test (AFOQT) Form S. . San Antonio, TX: Operational Technologies Corporation.

Shull, R. N., & Dolgin, D. L. (1989). *Personality and flight training performance*. Paper

presented at the 33rd Annual Meeting of the Human Factors Society.

In this paper, the relationships between a Risk Test, the Pilot Personality Questionnaire (PPQ),and a pass/fail training criterion and academic grades were examined. The authors also examined the relationships between the two predictor measures and the current U.S. Navy/Marine Corps aviation selection battery, the Academic Qualifications Test flight Aptitude Rating (AQTlFAR). Subjects were 407 student naval aviators (SNAs) and 182 student naval flight officers (SNFOs) who took the Risk Test and 110 SNAs and 1 14 SNFOs who took the PPQ. In the Risk Test, subjects are asked to choose which of ten squares is the reward square accumulating points as they go. The average number of responses (NR) and the corresponding average reaction time (RT) are measured for each trial. The PPQ is a self-administered personality inventory containing 112 multiple-choice items, which is a combination of 4 different personality tests: Locus of Control, Work and Family Orientation, Personality Attributes Questionnaire and a Social Desirability Scale. The AQT is a general cognitive ability measure and the FAR is comprised of the Mechanical Comprehension Test, the Spatial Apperception Test and the Biographical Inventory. Results showed that for the SNAs, the number of responses on the Risk Test correlated .13 @ < -05) with Undergraduate Pilot Training (UPT) pass/fail criterion and -. 13 ($p < .05$) with academic grades. Reaction time correlated -. 18 ($p < -05$) with UPT pass/fail. For the PPQ, the Social Desirability Scale correlated -.30 ($p < .05$) with UPT pass/fail and -.45 ($p < .05$) with academic grades. For the SNFOs, the number of responses on the gambling risk test correlated .28 ($p < .05$) with UPT pass/fail, while reaction time correlated -.45 ($p < .05$) with UPT pass/fail. Neither the number of responses nor the reaction time variables from the Risk Test were correlated with academic grades. For the PPQ, high self control correlated .40 @ < -05) with UPT pass/fail, but no other scales were correlated with this criterion. For the academic grades criterion, PPQ aggressiveness correlated .54 ($p < .05$), high competitiveness correlated -52 ($y < .05$) and submissiveness correlated -.55 @ < .05). The authors concluded that those trainees who exhibited more risk-taking behavior were more likely to complete flight training. However, the experienced pilots showed less risk-taking behavior than the SNAs. This may mean that although in training those that are successful are more likely to take risks, once they become pilots they demonstrate more cautious behavior (i.e., take more calculated risks where they can assess the likelihood of failing).

Shull, R. N., Dolgin, D. L., & Gibb, G. D. (1988). The Relationship between Flight Training Performance, a Risk Assessment Test, and the Jenkins Activity Survey: Naval Aerospace Medical Research Laboratory.

Current aircrew selection research at the Naval Aerospace Medical Research Laboratory has focused primarily on psychomotor and cognitive abilities. Evidence from studies on flight training attrition suggests that a number of failures may be attributed to personality or motivational factors rather than a lack of abilities. Because flight training success is a dynamic interaction of abilities, motivation, and personality factors, all three areas should be included to optimize the predictive validity of aircrew selection batteries. Two sets of data are presented; one set is from a computer based risk assessment task, and the other is from the Jenkins Activity Survey. The data indicated few relationships between risk assessment measures and flight training criteria. We found only one indication that increased risk taking was associated with successfully completing primary flight training. The Jenkins Activity Survey results indicated contradictory relationships between the scale measures and flight training criteria in the few significant findings observed.

Shull, R. N., & Griffin, G. R. (1990). Performance of Several Different Naval Aviator Communities on a Cognitive/Psychomotor Test Battery: Pipeline Comparison and Prediction. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Research is currently being conducted to develop reliable predictor tests which might aid in the making of decisions concerning aircrew assignment. The current approach involves comparing the performance of several different aviator communities on a test battery measuring various aspects of cognitive and psychomotor functioning. Four groups of pilots (two experienced jet groups, one experienced helicopter (helo) group, and one untrained student group) were tested on this battery. Overall, the jet groups performed in an equivalent manner, while the helo group showed a lower test performance level in comparison. The student group performed at a lower level than the experienced groups in general. Within this student group, pilot trainees who were assigned to the jet pipeline did significantly better on several of these tests than those trainees who were assigned to either helicopter or land-based fixed-wing pipelines. Many of the test performance differences seen between these jet and helo student pipeline groups were also seen between the experienced jet and helo pilots tested. Shull, R. N. and G. R. Griffin (1990). Predicting F-14 air combat maneuvering (ACM) performance using an automated battery of cognitive/psychomotor tests. Naval Air Station Pensacola, FL, Naval Aerospace Medical Research Laboratory. Some studies have suggested the possibility of predicting operational performance in fleet aviation environments. The current report concerns the use of an automated performance-based test battery, involving cognitive and psychomotor functioning, to predict the operational performance of fighter pilots. A group of jet pilots completing Air Combat Maneuvering (ACH) training in the F-I4 were tested on this battery. The few significant correlations found between the test measures and ACM performance measures were illogically patterned and of insufficient quantity or strength to establish that such a battery would reliably predict ACM performance. This could have been due to the homogeneous nature of the subject group in terms of pilot skills and abilities. Given these results, this particular test battery would probably not be useful in the prediction of flight performance at such a late stage of training as ACM, but it might predict flight performance in earlier training.

Shull, R. N., & Griffin, G. R. (1990). Predicting F-14 air combat maneuvering (ACM) performance using an automated battery of cognitive/psychomotor tests. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

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Shull, W. B. (1975). An investigation of the Air Force Officer Qualifying Test. *Dissertation*

Abstracts International, 36, 4942A.

Shull, W. B. (1975). *An investigation of the Air Force Officer Qualifying Test*. Paper presented at the 17th Annual Military Testing Association Conference, Indianapolis, IN.

Shultz, l. J., & Levine, A. S. (1951). Before the wild blue yonder: Counseling in the classification program for Air Force men. *Occupations, 31*, 182-185.

Siem, F. M. (1987). *The Effects of Aircrew Member Personality in Interaction and Performance.* Dissertation, University of Texas, Austin, TX.

Siem, F. M. (1988). *Current developments in research on Air Force pilot characteristics*. Paper presented at the 32nd Annual Meeting of the Human Factors Society, Anaheim, CA.

A personality inventory was given to 509 USAF pilot candidates. The items were combined into five measures. two of which differentiated training successes from failures; graduates demonstrated higher self-confidence and less dogmatism. As an alternative approach to examining simple relationships between personality characteristics and training outcomes personality profiles were examined as predictors of performance criteria. The value of this approach was demonstrated by better discrimination of training graduates from non-graduates. The implication of these results are discussed. as are plans for other research projects designed to replicate and extend the findings from the current study.

Siem, F. M. (1989). *Personality characteristics of USAF pilot candidates.* Paper presented at the Human Behavior in High Stress Situations Involving Aerospace Operations Conference.

Siem, F. M. (1990). *Development of a selection model for fighter-qualified USAF pilot candidates*. Paper presented at the American Psychological Association Annual Convention, Boston, MA.

The authors state that until recently, USAF pilots had been assigned to either fighter aircraft or tanker-transport aircraft based upon the recommendation of the advanced training recommendation board (ATRB). The purpose of this study was to develop a model to predict which USAF pilot candidates would be considered by the ATRB to be suitable for assignment to fighter aircraft using scores from the Air Force Officer Qualifying Test (AFOQT), the Basic Attributes Tests (BAT), college GPA and an index of candidates' preference for tanker-transport aircraft. A sample of 426 Officer Training School candidates were randomly assigned to one of two subsamples. For each subsample, multiple correlations were computed between the 42 variables and the ATRB recommendation outcome. These regression models were then each cross-validated in the other subsample. The full models for sample A and sample B were both significant ($R = .61$, $p < .001$; $R = SO$, $p < .05$, respectively). For each subsample, multiple regression was used to eliminate variables that did not contribute significantly to the prediction of ATRB outcome. For sample A, the final reduced model contained two predictors: AFOQT Instrument Comprehension and Response Time (RT) from the BAT Mental Rotation task ($R = .3$ 1, $p < .01$). For sample B, the reduced model contained seven predictors: AFOQT Instrument Comprehension and Block Counting; the BAT percent correct and RT variability from the Mental Rotation test and average tracking difficulty from the Time Sharing test; college GPA; and the desire to fly tanker-transport rating. For the cross-validity results, the model developed

for sample A, had a multiple correlation of -22 with ATRB recommendation outcome in subsample B. The model developed in sample B, had a multiple correlation of .26 with ATRB recommendation outcome in sample A. Based on these results a final model was developed that produced a multiple correlation of .40 @ < .001).

Siem, F. M. (1990). Predictive Validity of an Automated Personality Inventory for Air Force Pilot Selection. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

To examine the utility of personality testing for enhancing current Air Force pilot selection procedures, a sample of 509 USAF officers was given a computer-administered personality inventory, the Automated Aircrew Personality Profiler (AAPP) prior to entry into Undergraduate Pilot Training (UPT). Factor analysis of 16 scale scores indicated that the inventory comprised measures of five personality characteristics, of which three were directly associated with UPT training outcome (pass or fail): Self-confidence, Values Flexibility, and Hostility. UPT graduates scored higher on both positive dimensions and lower on hostility than did those individuals eliminated for flying training deficiency. The AAPP failed to add predictive utility to a selection model that combined test scores from the Air Force Officer Qualifying Test (AFOQT) and the Basic Attributes Tests (BAT) battery.

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Siem, F. M. (1991). *Predictive validity of response latencies from computer-administered personality tests*. Paper presented at the 33rd Annual Military Testing Association Conference.

In this paper, past research (e.g., Holden & Fekken, 1987) is discussed showing that individuals who scored high on a personality trait manifested shorter response latencies than individuals who scored low on that trait on items that were "endorsed." The opposite was found for items that were "rejected." Some interpret these results in terms of a "self-schema," which is an integrated network of self knowledge. Five hundred and nine Air Force student pilots entering Undergraduate Pilot Training (UPT; 332 for which training outcome was available) participated in this study. The Automated Aircrew Personality Profiler (AAPP) was administered and includes 94 items from the Minnesota Multiphasic Personality Inventory (MMPI). Scores were computed on the following scales: Sociability (Psychoticism), Emotional Stability (Neuroticism), Extraversion, Competency (Inadequacy) and Cynicism. The criterion used was UPT training outcome (pass/fail). Response latencies were standardized within subjects to control for reading speed and by item to control for item length and vocabulary level. For each subject and each

scale, a mean response time for endorsed items and one for rejected items was computed. Correlations between personality scores and UPT outcome were fairly weak. The only significant correlations with UPT were for Sociability ($r = .13$, $p < .01$) and Cynicism ($r = -.14$, $p < .01$). Correlations between response time scores with the criterion were only significant for endorsed items and then only for Extraversion and Cynicism. The author noted that the internal consistency for the sociability scale was only .34. Correlations between scale and response time variables for each trait were relatively small (ranging from .02 to .35). Correlations between the two response time measures (i.e., endorsed and rejected) for each trait were also small (ranging from -.01 to .-.26).

Siem, F. M. (1992). *Incremental validity of personality measures for predicting pilot training performance*. Paper presented at the American Psychological Association Annual Convention, Washington, DC.

Past research (e.g., Siem, 199 1) has indicated that personality measures based on inventory response latencies, as well as scale scores, have validity for predicting pilot training performance. The purpose of this study was to examine the incremental validities of these measures in predicting training performance. Specifically, two issues were addressed: (1) the factor structure of the scale scores and response latency scores were examined, with the expectation that the measures of the same trait would load on the same factor; and (2) the extent to which these personality measures would contribute unique variance to the prediction of training outcome was examined. Three hundred thirty-two college graduates who had been selected for Air Force pilot training were included in the factor analyses, 277 of these students were subsequently included in the multiple regression analyses. Scores from three predictors were used in this study: (1) the Basic Attributes Tests (BAT) - accuracy and response time scores were collected for the tests and psychomotor tasks; (2) the Automated Aircrew Personality Profiler (AAPP) - data on item endorsement and response time were collected for each item; and (3) the Air Force Officer Qualifying Tests (AFOQT). Undergraduate Pilot Training (UPT) was dichotomously scored pass/fail. Results of the factor analysis related to the first hypothesis showed that one factor was defined by the scale scores for the Emotional Stability, Sociability and Cynicism dimensions. Two factors were defined by loadings both of a scale score and a latency score (Extraversion & Cynicism). The remaining two factors were defined by loadings of latency variables only for Cynicism and Emotional Stability. Results related to hypothesis 2 showed that the full model correlated .36 ($p < .01$) with UPT pass/fail, the model with the five AAPP variables removed resulted in a R-change of .06 @ $< .05$). Thus, the personality variables did add to the prediction of UPT outcome beyond the AFOQT and the BAT. However, further analyses showed that all but one of the five AAPP variables, namely, Extraversion, could be removed from the model without a decrease in validity.

Siem, F. M. (1992). Predictive Validity of an Automated Personality Inventory for Air Force Pilot Selection. *International Journal of Aviation Psychology, 2*(4), 261-270.

Assesses the predictive utility contribution of personality measures on the pilot selection procedure of the U.S. Air Force. Demonstration of a direct relation between hostility, self-confidence and values flexibility to training outcome; Negative enhancement of the predictive validity of the selection system; Correlation between personality and aviation performance. Assesses the predictive utility contribution of personality measures on the pilot selection procedure of the U.S. Air Force. Demonstration of a direct relation between hostility, self-

confidence and values flexibility to training outcome; Negative enhancement of the predictive validity of the selection system; Correlation between personality and aviation performance.

Siem, F. M. (1995). *Future directions for pilot personality research*. Paper presented at the Aerospace Medical Association Meeting.

Siem, F. M. (1995). Optimal personnel assignment: An application to Air Force pilots. *Military Psychology, 7*(4), 253-263.

Siem, F. M. (1996). The use of response latencies to enhance self-report personality measures. *Military Psychology, 8*(1), 15-27.

Siem, F. M., & Alley, W. E. (1996). Optimal personnel assignment: An application to Air Force pilots. Brooks AFB, TX: Armstrong Laboratory.

Siem, F. M., & Carretta, T. R. (1986). *The development and initial validation of the basic attributes tests system*.

Siem, F. M., Carretta, T. R., & Mercatante, T. A. (1988). Personality, Attitudes, and Pilot Training Performance: Preliminary Analysis. Brooks AFB, TX: Air Force Human Resources Laboratory.

Developments in research concerning personality characteristics have led to a renewed interest in applications of individual differences measures for selection of pilot candidates. Recent research efforts have focused on selecting for positive characteristics, rather than screening out pathological traits. Another development is the use of tests in which the dimension of interest is not readily apparent to the examinee. In the present study, five personality and attitude measures were administered to 883 USAF pilot candidates as part of an experimental test battery under consideration for operational use in pilot selection and classification. These tests were designed to assess decisiveness, risk-taking, self-confidence, survival attitudes, and field dependence/independence. Scores from these tests wert examined for their utility in predicting training outcome (graduation or elimination) and advanced training recommendation (fighter or non-fighter aircraft). Results indicated that as a group, the tests demonstrated weak relationships with the performance criteria. No test manifested a consistent pattern of validity for both performance measures. Only the test of self-confidence appeared to contribute to predicting completion of training. Future research efforts are discussed with regard to refining the current test of self-confidence and establishing its construct validity.

Siem, F. M., Hagman, D. C., & Mercatante, T. A. (1988). *Current directions in Air Force pilot selection and classification research*. Paper presented at the 30th Annual Military Testing Association Conference, Arlington, VA.

Employment interviews are widely used In industry and the military for personnel selection and classification, although the scientific evidence for their validity and reliability is somewhat weak (Arvey & Campion, 1982; Harkness,1987). The U.S. Air Force does not currently use a routine interview process for pilot selection, other than that conducted for recruiting purposes, although some components of the Air Force do rely on their own procedures. Units of the Air National Guard, for instance, have used an interview process with

some success (Armour, personal communication, October 10, 1987). Based on the perceived success of an interview process used by the Air National Guard, , a study was undertaken to assess the validity of an interview for selecting Air Force pilot candidates. In particular, the issue of Interest was whether instructor pilots could use a structured interview technique to assess an applicant's potential for pilot training. The content of the interview was derived from a review of the instrument used by the Air National Guard and through discursions with subject matter experts of the Air Force Air Training Command (ATC), the organization responsible for training all Air Force, Air National Guard and Air Force Reserve pilot candidates.

Siem, F. M., & Murray, M. W. (1993). *Personality factors affecting pilot combat performance*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

Studies based on pilot performance in combat suggest that individual differences in personality characteristics are important to effective performance (Bair, 1952; Jenkins, Ewti, & &roll, 1950; Stanley, 1973; Youngling, Levine, Mochamuk, & Weston.1977). Nonetheless, qualitative reviews of the literature have generally been pessimistic toward empirical evidence supporting the hypothesis that personality characteristics are important to effective pilot performance, despite the large number of characteristics examined using a variety of different instruments in a multitude of studies (Dolgin & Gibb, 1988). One possible explanation for the failure to find stronger relationships may be due to the lack of a suitable conceptual framework for evaluating results from different studies. Efforts to identify such a framework have led to a consensus model of personality based on the observation that five global factors adequately describe individual differences in personality traits (Digman, 1990; Tupes & Christal 1961). These factors, known as the –Big Five," are (I) Extroversion, (II) Agreeableness, (III) Conscientiousness, (IV) Emotional Stability, and (V) Culture, or Openness to Experience (Costa & McCrae, 1992).

Siem, F. M., & Murray, M. W. (1994). Personality factors affecting pilot combat performance: a preliminary investigation. *Aviation, Space, and Environmental Medicine, 65*(5), A45-A48.

Siem, F. M., & Sawin, L. L. (1990). *Comparison of Male and Female USAF Pilot Candidates, In Recruitment, Selection, and Training and Military Operations of Female Aircrew*. Paper presented at the 69th Symposium of the Aerospace Medical Panel.

Signori, E. I. (1949). The Arnprior experiment: A study of World War II pilot selection procedures in the RCAF and RAF. *Canadian Journal of Psychology, 3*, 136-150.

This article presents validity evidence for the pilot selection battery employed by the Royal Canadian Air Force (RCAF). This battery includes a variety of predictor variables ranging from cognitive ability to biodata to psychomotor coordination. Several different criterion measures were also used ranging from a training pass/fail criterion to various flight training and ground school ranks. Results showed that the RCAF Visual Link Test was the most valid predictor variable (zero-order validities ranging from .18 for initial training school rank to -57 for elementary flying training school rank). The validities for the Aircrew Information Sheet (biodata) ranged from .O1 for elementary and service flight training school to .20 for initial training school rank. The validities for the Aircrew Interview Report Form (motivation and

attitude appraisal) ranged from .06 for elementary flight training school pass/fail to .16 for initial training school rank. The authors conclude that the RCAF battery compares favorably with the 1943 U.S. Air Force selection battery.

Silva, J. M. (1997). Using Psychomotor Ability for Selecting TOW Gunners. (pp. 30). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The situation awareness (SA) and mental workload of 56 subjects were evaluated as they monitored one or more attributes of six objects moving systematically over a rectangular grid. Subjects were assigned to one of seven groups depending upon whether they were to monitor object locations (location task), object colors (color task), whether the objects flashed (flash task), or some combination of these three. Both task performance and subjective ratings were used to assess subjects' awareness of the three object attributes. In addition, subjective ratings of mental workload were collected. All subjects performed the monitoring task under four different conditions formed from the factorial combination of 1) the probability that objects of a certain color would flash and 2) whether object colors remained consistent or changed during the course of a trial. The results pointed to the usefulness of both flash and color task performance as measures of SA. Subjects were very poor at the location task, suggesting either their location awareness was poor or the location task is not a good measure of that awareness. Subjective ratings proved useful but occasionally dissociated from task performance. One possibility is that subjective ratings reflect rational inferences b the subjects rather than the outcome of their introspections.

Simon, E., Watts, D., & Bohnker, B. K. (2008). Helicopter mishap attributed to single seizure. *Military Medicine, 173*(3), 322-323.

A case report is presented of a 36-year-old U.S. Coast Guard aviator who had a single seizure while operating a helicopter on the ground. His seizure activity produced a loss of consciousness during which he pushed the cyclic to the left anterior quadrant that resulted in a ground mishap. No risk factors were identified in an extensive neurological workup. The current guidance for handling seizures in military aviation personnel is reviewed, along with considerations for treatment. Although the military aviation selection process carefully screens applicants for seizure history and potential, occasional seizures in the aviation population remain possible. Such events may result in military aircraft mishaps despite careful risk factor surveillance, as demonstrated by this case.

Simons, J. C., Boyett, J. E., McGraw, M. E., & Askren, W. B. (1988). Models that relate helicopter crew task performance to combat success. Volume III - validation test plan. Dayton, OH: Universal Energy Systems, Inc.

Singh, G. (1991). *Comparative analysis of MMPI profiles in two groups of ab Initio flying trainees*. Paper presented at the 6th International Symposium on Aviation Psychology.

Sipes, W. E., Moore, J. L., & Caldwell, J. L. (1991). *The Minnesota Multiphasic Personality. Inventory (MMPI): Military Pilot Norms*. Paper presented at the 33rd Annual Military Testing Association Conference, San Antonio, TX.

Pilot standards in the military are stringent with high physical, mental and psychological criteria. When testing military pilots, two areas of concern are addressed. The first is the

occupational question of whether this pilot is like other pilots and is safe to fly and able to complete the mission. The second is the clinical question of whether this pilot has a diagnostic and treatable psychiatric condition or disorder that immediately excludes the pilot from flying until treatment is successfully completed. The MMPI may be helpful in answering these two questions, but a normative sample of pilots has been lacking in the past. Given these selection and continuation standards, military pilots are expected to have the same general MMPI profile across time and military services. It was hypothesized that "normal" (not having received any psychiatric diagnosis) pilot groups from the US Air Force, Army and Navy have MMPI profiles not significantly different from one another regardless of the passage of time. A second hypothesis was that groups of military pilots would be significantly different from the civilian norms on at least eight scales: K-correction (K), Hypochondriasis (Hs), Hysteria (Hy), Psychopathic Deviate (Pd), Psyhasthenia (Pt), Schizophrenia (SC), Hypomania (Ma), and Social Introversion (Si) as shown in a previous study (Fulkerson, Freud and Raynor, 1958).

Sisson, E. D. (1948). The personnel research program of the Adjutant General's Office of the United States Army. *Review of Educational Research, 18*, 575-614.

Small. (1959). The validity of the sub-scores of the aviation qualification test: Navy.

Smith, G. (2008). *RAFAAT & TSD-PI as Predictors of Aerospace Control Performance*. Paper presented at the 50th Annual International Military Testing Association Conference, Amsterdam, Netherlands.

Air Traffic & Air Weapons Control offer highly complex, critical entry-level jobs AEC relies upon the same generic system use to select General Service Officer classifications & NCM occupations Training serials filled on ‗first-passed-the-post' basis Only difference for AEC selection is interim CFAT Total cut-off score at 60th percentile AEC has experienced significant training attrition rate since 2000 (e.g., 1999 - 60%, now averaging 35%) Current selection criteria unable to further decrease training attrition aim To determine predictive validity of RAFAAT & TSD-PI in Aerospace Control training & job performance.

Smith, G. A. (2003). *Whom among us? Preliminary research on position and personnel selection criteria for MALE UAV sensor operators*. Paper presented at the 45th Annual International Military Testing Association Conference, Pensacola, FL.

Net-centric warfare and interoperability are fast becoming basic tenets of modern military strategic thought. The Canadian Forces and its NATO allies are currently conducting research into the effective use of current and emerging technologies such as airborne sensors and uninhabited aerospace vehicles (UAVs) to enhance their intelligence, surveillance, and reconnaissance (ISR) capabilities. Effective sensor operation is critical to the successful support of UAVs to Canada‗s joint and combined net-centric warfare capability. The selection, training, and employment of Canadian Forces personnel as sensor operators will depend upon an accurate analysis of this position‗s requirements and upon the determination of whom among us has the appropriate training and experience to competently fill this vital ISR position. Canadian Forces UAV experimentation is developing an understanding of the generic task and knowledge requirements of the Medium Long Endurance (MALE) UAV Sensor Operator position to that end. This paper discusses the methods and techniques used over the course of three major research events to determine the position and personnel selection criteria for MALE UAV Sensor

Operators and provide preliminary results from Canadian Forces research to date.

Smith, G. M., Bjerke, E., NewMyer, D. A., Niemczyk, M., & Hamilton, R. A. (2010). Pilot Source Study: An Analysis of Pilot Backgrounds and Subsequent Success in US Regional Airline Training Programs. *International Journal of Applied Aviation Studies, 10*(1), 73-93.

The 2010 Pilot Source Study, commissioned to research the success of pilots in initial training for Part 121 operations, analyzed the training performance of 2,156 new-hire pilots in the years 2005-2009. Six regional airlines provided data that was mined from human resource and pilot training files. Five university researchers independently analyzed the data and integrated their results. The study expressed success in terms of fewer extra training events and fewer non-completions in regional airline training. Statistically, the best performing pilots were those who had flight instructor certificates, graduated from collegiate accredited flight programs, received advanced (post-Private) pilot training in college, graduated with collegiate aviation degrees (any aviation discipline), and had between 500 and 1,000 pre-employment flight hours. Pilot source characteristics that had no significance in regional airline pilot training success were: having a non-aviation college degree and having prior corporate pilot or airline pilot experience.

Smith, P. C., & Gold, R. A. (1956). Prediction of success from examination of performance during the training period. *Journal of Applied Psychology, 40*, 83-86.

Smith, R. C. (1971). Personality assessment in aviation: An analysis of the item ambiguity characteristics of the 16PF and MMPI. Oklahoma City, OK: FAA Civil Aeromedical Institute.

Devices such as the 16PF and MMPI have been widely employed in the evaluation of personnel in aviation settings . The present study investigated the problem of item ambiguity (the degree to which an item elicits multiple interpretation) which may limit the utility of such devices when used in screening procedures. Subjects complete either the 16PF or the MMPI while concurrently rating each item on a five-point ambiguity scale. The ambiguity for each item was determined and the relationship between ambiguity and sex of the respondent, the individual factor scales, and the scores of subjects on the scales was considered. The implications of the findings for item construction and use of the test in various applications were discussed.

Smith, R. L., & McAnulty, D. M. (1985). Test-retest reliability of the Revised Flight Aptitude Selection Test (RFAST). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Snyder, J. F. (1951). Personality research in Naval aviation selection. *Journal of Aviation Medicine, 22*, 530-534;553.

Snyder, Q. C. (1991). Assessment of Two Depth Perception Tests to Predict Undergraduate Pilot Training Completion. . Wright-Patterson Air Force Base, OH: Air Force Institute of Technology.

This document is a proposal for a publishable research paper. Ophthalmologists at the USAF School of Aerospace Medicine suspect one of the two depth perception tests used to

screen candidates for Undergraduate Pilot Training (UPT) inadequately evaluates depth perception abilities required to operate high performance jet aircraft. They hypothesize that candidates passing only the Verhoeff test for near stereopsis have higher attrition rates from UPT than candidates passing the VTA, a test of distant stereopsis. A historical prospective study will be used to test this hypothesis. A cohort of students attending USAF UPT during Fiscal Year 1990 will be compared. UPT attrition rates will be compared among type of depth perception test passed. Multiple logistic regression methods will be used to study attrition rate increases. Confounding variables evaluated include: commissioning source, previous flying experience, training base assigned, degree of phoria and gender of student. If this hypothesis is validated, the USAF may amend its pre-selection depth perception criterion for medical qualification of UPT candidates, thus resulting in significant financial savings to the US Air Force.

Snyder, Q. C. (1993). Prospective assessment of stereoscopic visual status and USAF training attrition. *Aviation, Space, and Environmental Medicine, 64*, 14-19.

Sommer, M., Olbrich, A. and Arendasy, M. (2004). Improvements in personnel selection with neural networks: A pilot study in the field of aviation psychology. *International Journal of Aviation Psychology, 14*(1), 103-115.

Sommer, M., Häusler, J., Koning, A. J., Arendasy, M., & Schufried, G. (2006). *Validation of the Dutch Airforce test battery using artificial neural networks*. Paper presented at the 48th Annual International Military Testing Association Conference, Kingston, ON, Canada.

The main selection criteria for individual tests and test batteries used to select military pilot applicants are the construct and criterion validity, the overall cost of testing and the time requirements. Naturally, the derivation of decisions from a test battery requires a sufficiently high correlation between the tests and the criterion variable. However, recent metaanalysis (cf. Burke, Hobson & Linsky, 1997; Hunter & Burke, 1994; Martinussen, 1996) indicates that the correlation coefficients between a single test and the criterion measure do not exceed an absolute value of .30. There are a variety of causes for this, ranging from a lower reliability of the criterion or predictor variables (Lienert & Raatz, 1998; Goeters, 1998), an attenuation of the variance in the predictor variables due to selection (Lienert & Raatz, 1998; Goeters, 1998) to the lack of symmetry between the generality of the predictor variables and the generality of the criterion variable. With regard to the later cause Wittmann and Süß (1997), Ajzen (1987) and Ree and Carretta (1996) pointed out that for more general and global criteria such as successful performance in a flight-simulator or an educational program, aggregate measures such as general ability (~~–g~~") are better suited for prediction than more specific predictors. Thus one way to handle this problem is to combine the available information about an applicant to generate a prediction about his success. In general, one can resort to various methods of statistical judgment formation in order to do so. But classical methods of statistical judgment formation such as discriminant analysis or regression analysis are vulnerable to violations of their statistical assumptions and often lack stability in cross-validation in practical applications (cf. Bortz, 1999; Brown & Wickers, 2000). A promising alternative is the use of artificial neural networks. This statistical method has few requirements with respect to data characteristics and has proven to be a robust procedure for pattern recognition tasks (Bishop, 1995; Kinnebrock, 1992; Mielke, 2001; Rojas, 2000; Warner & Misra, 1996).

Sommer, M., Hausler, J., & Schuhfried, G. (2005). *Validation of two aviation psychology test battery using artificial neural networks*. Paper presented at the 47th Annual International Military Testing Association Conference, Singapore.

The main selection criteria for individual tests as well as test batteries used to select pilot applicants are the criterion validity, the overall cost of testing and time requirements. The selection of the respective tests can be based on recommendations of the Joint Aviation Requirements for Crew Licensing 3 (JAR-FCL3) and validation studies. Naturally, the derivation of decisions from a test battery requires a sufficiently high correlation between the tests and the criterion variable. However, recent metaanalysis (cf. Hunter & Burke, 1994; Burke, Hobson & Linsky, 1997) indicates, that the correlation coefficients between a single test and the criterion measure don‘t exceed an absolute value of .30. There are a variety of causes for this, ranking from a lower reliability of the criterion- or predictor variables (Lienert & Raatz, 1998), an attenutation of the variance in the predictor variables due to selection (Lienert & Raatz, 1998) to the lack of symmetry between the generality of the predictor variables and the generality of the criterion variable. With regard to the later cause Wittmann and Süß (1997), Ajzen (1987) and Ree and Carretta (1996) pointed out, that for more general and global criteria such as successful performance in a flight-simulator or an aviation educational program, aggregate measures such as general ability („g“) are better suited for prediction than more specific predictors. Thus, one way to handle this problem is to combine the available information about an applicant to generate a prediction about her or his success. In general, one can resort to various methods of statistical judgment formation in order to do so. But classical methods of statistical judgment formation, such as the discriminant analysis or the regression analysis, are vulnerable to violations of their statistical assumptions and often lack stability in cross-validation in practical applications (cf. Bortz, 1999; Brown & Wickers, 2000). A promising alternative is the use of artificial neural networks. This statistical method has few requirements with respect to data characteristics and has proven to be a robust procedure for pattern recognition tasks (Bishop, 1995; Kinnebrock, 1992; Mielke, 2001; Rojas, 2000; Warner & Misra, 1996).

Sorsa, M. (1992). *Airline pilot's policy on selection*. Paper presented at the Western European Association for Aviation Psychology Conference.

Spaven, M. (2001). The transition business. *Civil Aviation Training,* 31-34.

Spaven, M. (2005). European pilots in demand. *Civil Aviation Training,* 10-13.

Speilberger, C. D., & Barker, L. R. (1979). The relationship of personality characteristics to attrition and performance problems of Navy and Air Force Recruits. Orlando, FL: Training, Analysis and Evaluation Group.

Spinner, B. (1989). *Using the Canadian Automated Pilot Selection System to predict performance in primary flying training: Straight and level flight*. Paper presented at the 5th International Symposium on Aviation Psychology, Columbus, OH.

Spinner, B. (1991). Predicting Success in Primary Flying School From the Canadian Automated Pilot Selection System: Derivation and Cross-Validation. *International Journal of Aviation Psychology, 1*(2), 163.

Spinner, B. (1994). Norms for CAPSS‘ predicted probability of passing flying training. Willowdale, ON: Canadian Forces Personnel Applied Research Unit.

Spinner, B. (1996). The Canadian Automated Pilot Selection System (CAPSS): Predicting success in Basic Flying Training- Cross-validation results. Willowdale, ON: Canadian Forces Personnel Applied Research Unit.

Sprenger, W. D., & Fallesen, J. J. (1988). *Complex cognitive assessment battery: Performance, demographic and attitudinal aspects*. Paper presented at the Annual Meeting of the Military Testing Association, Arlington, VA.

Staff. (1919). Selection of the flier *Air Service Medical* (pp. 17-28). Washington, D.C.: Government Printing Office.

Staff. (1942). An analysis of officer candidate failures. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Staff. (1942). Causes of failure to complete officer candidate courses. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Staff. (1943). Initial selection of candidates for pilot, bombardier, and navigator training. Washington, DC: Assistant Chief of Staff, Intelligence, Historical Division.

Staff. (1945). Construction and selection of items for the Biographical Information Blank. Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Staff. (1945). An investigation into the possibilities of a suppression key for the Biographical Information Blank. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Staff. (1945). Obtaining officer preference and officer characteristics scale values of adjectives for use in construction of items for the Biographical Information Blank. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Staff. (1954). Selection of Army and Air Force Reserve Officer Training Corps students. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Staff. (1955). Psychological Research on Pilot Training in the AAF (Psychological Research Project [Pilot]). *American Psychologist, 10*, 7-16.
This is the tenth of a series of articles (1, 2, 3, 4, 5, 6, 7, 8, and 9) dealing with the Aviation Psychology Program under the direction of the Office of the Air Surgeon, Headquarters Army Air Forces.

Staff. (2006). It pays to be assessed. *Civil Aviation Training,* 28-30.

Staff of the Army Air Forces. (1945). History, organization, and research activities, psychological research project. *Psychological Bulletin, 42*, 751-759.

Staff of the Psychological Branch. (1943). The aviation psychological program of the Army Air Forces. *Psychological Bulletin, 40*, 759-769.

Staff of the Psychological Section. (1945). Psychological activities in the Training Command, Army Air Forces. *Psychological Bulletin, 42*, 37-54.

Stanley, M. D. (1973). *A Method for Developing a Criterion for Combat Performance of Naval Aviators.* Master of Science, Naval Postgraduate School, Monterey, CA. Current Naval aviator selection and screening procedures are based on the individual's statistical probability of completing flight training and do not determine the capability of the student to adapt to an operational environment. The resultant failure of some student aviators to complete the advanced stages of training and the ineffective performance of others in operational missions have caused a considerable financial loss and a lessening of combat readiness A critical incident study, using 30 aviators who have combat experience, indicates that there are 10 categories of behavior which characterize effective and ineffective Naval aviators. Procedures to identify these categories early in flight training are discussed.

Stanny, R. R., Reeves, D. L., Blackburn, M. R., & Banta, G. R. (1988). Neuroelectric Selection of Naval Aviation Personnel: An Evaluation. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

The problem of devising rational means to select candidates for flight has been with us for over 75 years now. It has become more important as aircraft have become more complicated and training more expensive. Selection for flight in the U.S. Navy is based on considerations of academic histories, written tests, physical examinations, and biographical information. The net effect is a substantial improvement over random selection. Nevertheless, perhaps 30% of those who enter flight training do not finish (1). Hence there is continuing interest in improving the selection process. Possibly the first attempt to use the EEG to forecast the performance of naval aviators was carried out by Alexander Forbes and Hallowell Davis as a part of the Pensacola Study of Naval Aviators of 1940-1941 (2,3).1 Forbes and Davis examined the electroencephalograms (EEGs) of several hundred Navy flight candidates for signs of epilepsy. They found no reliable association between the presence of minor EEG abnormalities and later flight performance.

Stauffer, J., & Ree, M. J. (1996). Predicting pilot training success with logistic or linear regression: An example where it doesn't matter and why. *International Journal of Aviation Psychology, 6*, 233-240.

Stead, G. (1991). A validation study of the QANTAS pilot selection process. In E. Farmer (Ed.), *Human Resource Management in Aviation* (Vol. 1, pp. 3-18). Brookfield, VT: Avebury.

Stead, G. (1994). *Qantas pilot selection procedures: past to present*

Steindl, J. R., & Ree, M. J. (2000). *The Role of Cognitive Ability and Personality in the Training Success of Norwegian Pilots*. Paper presented at the 42nd Annual International Military Testing Association Conference, Edinburgh, UK.

The causal role of general cognitive ability (g), personality, English proficiency, prior job knowledge, and training job knowledge on passing/failing flying training in the Norwegian Air Force was investigated. All the independent variables, with the exception of personality, were collected by paper and pencil measures. Personality was collected through the Defense Mechanism Test (DMT (Kragh, 1960); DMT-NPI (Neuman, 1978)), a tachtistiscopic presentation of stimuli and ratings by a psychologist. The criterion consisted of a dichotomous pass/fail measure of pilot performance determined by the flight instructors. There was a direct influence of g on English proficiency and prior job knowledge, and an indirect path from g to pass/fail going through English proficiency, prior job knowledge, and job knowledge acquired in training. Personality showed a direct influence on the acquisition of prior job knowledge and on passing/failing pilot training only.

Stewart, J. E. (2006). Locus of control, attribution theory, and the "five deadly sins" of aviation. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The construct of Locus of Control (LOC) has been shown to predict a broad range of attitudes and behaviors, including risk taking and risk management, the performance of multiple tasks, distractibility, and the subjective perception of time. The above topics and many others have applicability to aviation settings. Over the past two decades, a few researchers have examined the relationship between LOC and hazardous attitudes, pilot errors, and other variables relating to safety and risk management. Most of this work has been correlational, and, in many instances, sample size has been quite small. The present paper reviews this work and other areas of research, which, though not specifically tied to aviation, have potential relevance to it. These include concepts from attribution theory, such as the optimism bias, in which people tend to attribute greater competency and lesser vulnerability to themselves than to similar others. Suggested applications of established and existing research in applied areas of social psychology are examined, with a focus on their relevance to aviation.

Stoker.). *The defence mechanism test as a measure for the selection of fast-jet pilots: Empirical experience in the royal air force*

Stoker, P. (1982). An empirical investigation of the predictive validity of the Defense Mechanism Test in the screening of fast-jet pilots for the Royal Air Force. *British Journal of Projective Psychology and Personality Study, 27*(1), 7-12.

Stoker, P., Hunter, D. R., Kantor, J. E., Quebe, J. C., & Siem, F. M. (1987). Flight screening program effects on attrition in undergraduate pilot training. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Stokes, A. F., Banich, M. T., & Elledge, V. C. (1991). Testing the tests--an empirical evaluation of screening tests for the detection of cognitive impairment in aviators. *Aviation, Space, and Environmental Medicine, 62*, 783-788.

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Stokes, A. F., & Bohan, M. (1995). *Academic proficiency, anxiety, and information-processing variables as predictors of success in university flight training*. Paper presented at the 8th International Symposium on Aviation Psychology.

Stratton, G. M. (1919). Psycho-physical tests of aviators. *Scientific Monthly, 8*, 421-426.

Stratton, G. M., McComas, H. C., Coover, J. E., & Bagby, E. (1920). Psychological tests for selecting aviators. *Journal of Experimental Psychology, 3*(6), 405-423.

Street, D. R., Chapman, A. E., & Helton, K. T. (1993). *The future of naval aviation selection: Broad-spectrum computer-based testing*. Paper presented at the 35th Annual Military Testing Association Conference, Williamsburg, VA.

A number of procedures have been used by the U.S. military to improve the selection of potential military pilots. These procedures have usually focused on the assessment of psychomotor skills, intellectual abilities, and personal attitudes/interests commonly found in successful aviators. Since WWI, the U.S. Navy and Marine Corps have selected student aviators based on a battery of paper-and-pencil tests. Eligibility to take the selection test battery requires a college degree and a flight physical. The current selection test, the U.S. Navy/Marine Corps Aviation Selection Test Battery (ASTB), was developed to replace the Aviation Qualification Test/Flight Aptitude Rating (AQT/FAR). The AQT/FAR had been used unchanged since 1973. This test series was developed during WWII and includes four basic content areas: 1) general scholastic-related ability, 2) mechanical reasoning, 3) spatial reasoning, and 4) background experiences and interests. Extensive research has shown that the AQTIFAR was a valid predictor of aviation training success. The ASTB, like the AQT/FAR, is a paper-and-pencil test that takes approximately 2 hours to complete. The ASTB was developed jointly by the U.S. Navy and the Educational Testing Service (ETS) in Princeton, New Jersey. The development of questions for the ASTB was based on an extensive job and skill analysis conducted by ETS and the Navy. It is broadly useful for aviation and naval officer training and is comprised of 6 subtests that cover the same content areas as the AQT/FAR. Unlike earlier versions that targeted only attrition, the item selection and scoring of the ASTB is based on the ability to predict primary flight grades and training attrition.

Street, D. R., & Dolgin, D. L. (1992). The efficacy of biographical inventory data in predicting early attrition in Naval aviation officer candidate training. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Attrition in the training of U.S. naval aviation officer candidates represents a historic problem. The early identification of those likely to attrite during training would significantly reduce overall training expenditures. In this study, we assessed the value of biographical information for predicting early attrition at the indoctrination level of naval aviation officer training. We selected a random sample of 1551 aviation officer candidates and naval aviation cadets for analysis. The subjects selected had taken the Aviation Selection Test Battery (ASTB) between 1987 and 1990 and had completed the aviation indoctrination program operated by the Naval Aviation Schools Command in Pensacola, Florida. A principal component factor analysis of Biographical Inventory items was conducted with those who passed (N - 1176) and also with those who attrited (N = 375) basic aviation indoctrination. The resultant factors were then forced into a discriminant function analysis to determine if the factors obtained were different for the

two groups. We found that the factors were significantly different for the two groups. The results indicate that biographical data may be useful in identifying candidates who are most likely to attrite early from naval aviation training.

Street, D. R., & Dolgin, D. L. (1993). An evaluation of personality testing and the Five-factor model in the selection of landing craft air cushion vehicle crew members. Naval Air Station Pensacola, FL: Naval Aerospace Medical Laboratory.

Street, D. R., & Dolgin , D. L. (1994). Computer-Based Psychomotor Tests in Optimal Training Track Assignment of Student Naval Aviators. (pp. 18). Pensacola, FL: Naval Aerospace Medical Research Laboratory.

The purpose of our investigation was to determine if computer-based selection tests could predict training track assignment for student naval aviators. This study evaluated the predictive efficacy of an experimental battery of computer-based pilot selection tests for training classification. Student naval aviators are currently assigned to an aircraft training track based primarily on performance in primary training. Students were tested on the experimental test battery and classified into one of three aircraft training tracks based on their test scores. The resulting classifications were compared to actual selections made as the students progressed through naval aviation training. Using a sample of 237 students, linear analyses were conducted to evaluate the efficacy of predicted decisions. The unique contribution of the experimental battery was determined by comparing scores on the experimental battery to scores on the Navy/Marine Corps Aviation Selection Test Battery, a paper-and-pencil pilot selection test used by the United States Navy and Marine Corps, and student primary flight training grades. A significant classification model including one of the experimental selection tests was derived. The model was able to significantly predict fast attack pipeline selections before flight training.

Street, D. R., Dolgin, D. L., & Helton, K. T. (1993). *Personality tests in an enhanced selection model*. Paper presented at the 7th International Symposium on Aviation Psychology, Columbus, OH.

Street, D. R., Helton, K. T., & Dolgin, D. L. (1992). *Personality Tests to Predict Success in Navy Pilot Training*. Paper presented at the 34th Annual Military Testing Association Conference, San Diego, CA.

The increasing cost of training aircrew to operate modern naval aircraft and the simultaneous decline in retention rate for these same trained aircrew increase the importance of utilizing the best selection methods available. This importance is underscored by the fact that every aircrew selectee who fails to complete training contributes to a potential operational personnel shortage if expected replacements necessary to maintain military readiness do not materialize as planned. Pilot selection research to date has generally focused on the testing of various psychomotor and cognitive abilities (Carretta, 1986; Davis, 1989; Dolgin & Gibb, 1989; Hilton & Dolgin, 1990). While these abilities would seem logically necessary for successful performance in flight training, some failures may be due, at least in part, to personality and/or motivational factors (Helmreich, 1982). Historically, researchers have tried to fmd the ideal aviator personality profile among numerous personality measures. This ideal aviator personality profile has often been anecdotally called ~~-t~~he right stuff." Promising results have been found in identifying characteristics that improve the likelihood of later success in aviation such as

persistence, motivation, coolness under pressure (clear thinking), and novel problem solving (e.g., Retzlaff & Gibertini, 1987). Other researchers have considered personality factors with varying degrees of success (Dolgin & Gibb, 1989; Hunter & Burke, 1991). Certain personality characteristics or traits may correlate highly with success in initial/primary flight training. For example, interpersonal orientation, self-assertiveness, and achievement motivation are associated with pilot attitude and performance (Helmreich, Sawin, dc Carsrud, 1986). Important developments in personality assessment have included attempts to avoid response bias by masking the personality dimension of interest and to screen for positive attributes, in contrast to a past emphasis on psychopathology (Picano, 1991).

Street, D. R., Helton, K. T., & Dolgin, D. L. (1992). The unique contribution of selected personality tests to the prediction of success in naval pilot training. Naval Air Station Pensacola, FL: Naval Aerospace Medical Research Laboratory.

This study concerns the relationship of naval flight training performance to scores on the Aviation Qualification Test/Flight Aptitude Rating (AQT/FAR) and the automated Pilot Personality Questionnaire (PPQ). We analyzed a sample of 211 pilot candidates who had taken the AQT/FAR and PPQ. We found that the PPQ competitiveness scale and three of the AQT/FAR subtest score means were significantly different ($p < .05$) for those who passed (N - 168) and those who attrited (N - 43) flight training. Discriminant analysis yielded a linear composite of the AQT/FAR and PPQ subtest variables that could be used to classify the students according to the likelihood of passing or attriting during flight training. The resulting discriminant function explained 9% of the variance in the pass/attrite criterion ($r = .30$). We found that a 50% reduction in attritions could be attained with a 23% increase in false rejections. The regression analysis as significant ($p < .01$) and indicated that three scales of the PPQ and the AQT and FAR scores accounted for unique variance in a linear prediction equation. The FAR and PPQ competitiveness scale were the most powerful predictors of overall flight training success.

Street, D. R., Helton, K. T., & Nontasak, T. (1993). An evaluation of personality testing and the five-factor model in the selection of landing craft air cushion vehicle crew members. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

The purpose of our investigation was to determine if personality testing and a five-factor model could improve the selection of Landing Craft Air Cushion (LCAC) vehicle crew members. Vehicle crew members for the LCAC are currently selected by their performance on a computer-based psychomotor selection system. The various psychomotor tests in the selection system have demonstrated predictive validity in LCAC crew training. Certain personality characteristics may also be involved in the LCAC vehicle crew training success. In fact, various researchers have found that personality testing may improve the selection of Navy/Marine Corps aviators. Increasing evidence indicates that a five-factor model may be useful in describing the personality characteristics involved in training success. We believe that a five-factor model may improve the selection system used for LCAC vehicle crew members. A principal component analysis with varimax rotation was conducted to determine the underlying structure of the Adult Personality Inventory with 168 LCAC crew candidates. The resulting factor scores were then statistically analyzed to determine the relation of the personality factor scores and the performance-based test to an underway grade in training criterion. The results indicated that one personality factor, openness, significantly improved predictions of the criterion ($p < 0.05$). Based

on these results, we believe that personality testing would improve the selection of LCAC vehicle crew members.

Stricker, L. J. (1993). *The Navy's Biographical Inventory: What Accounts for Its Success?* Paper presented at the 25th Annual Military Testing Association Conference, Williamsburg, VA.

The Biographical Inventory in the Navy's aviation selection battery is interesting and important from both historical and psychometric perspectives. This traditional inventory, composed of heterogeneous items selected and keyed to predict retention vs. attrition of student naval aviators in flight training, has evolved over the years but can be traced back to the one used in World War II. This device has consistently been one of the most valid predictors of retention vs. attrition in the battery, overshadowing tests of general ability, mechanical comprehension, spatial ability, and aviation information (e.g., Fiske, 1947) It has been speculated that the inventory tapes maturity and risk taking (Petho, 1980), but the reasons for its success have so far not been explored. Accordingly, the purpose of this study was to assess the dimensions underlying the inventory and their relations with retention vs. attrition of aviators in naval aviation training. (A parallel investigation of flight officers is underway.)

Stricker, L. J. (2005). The biographical inventory in naval aviation selection: Inside the black box. *Military Psychology, 14*(1), 55-67.

A biographical inventory has been used in the selection of students for naval aviation training since World War II, and its validity in predicting their retention in this training has been well established. This study investigated the constructs underlying the inventory and their relations to student retention criteria. A factor analysis of the items on the inventory for student pilots identified five factors. One factor, being a commissioned officer, appeared to account for the inventory‘s validity.

Strickland, T. (2004). *Air Force pilot selection assessments*. Paper presented at the 52nd Meeting of the Department of Defense Human Factors Engineering Technical Advisory Group, Alexandria, VA.

Strong, E. K. (1918). Work of the committee on classification of personnel in the Army. *Journal of Applied Psychology, 2*((2)), 130-139.

Discusses various functions of the Committee on Classification of Personnel in the Army: (1) classifying personnel according to their military qualifications (2) establishing the Trade-Tests division (3) enlisting the occupational needs of units in a division (4) extending the personnel work to staff corps troops (5) establishing the Central Personnel Bureau (6) appointing a committee on education and special training (7) organizing the War Service Exchange (8) rating the officers and candidates for commissions in the Officers Training Camps (10) cooperating with the Provost Marshall General (11) reducing the army paper work (12) enlisting the intelligence ratings of army men and (13) selecting aviators and navy men.

Suarez, J., Barborek, S., Nikore, V., & Hunter, D. R. (1994). Current trends in pilot hiring and selection. Washington, DC: Federal Aviation Administration Office of Aviation Medicine.

Sullivan, A. (1919). *Aviation in Canada 1917-1918*. Toronto: Rous & Mann Limited.

Super, D. E. (1944). Clinical research in the aviation psychology program of the Army Air Forces. *Psychological Bulletin, 41*, 551-552.

Super, D. E. (1947). Validity of standard and custom built personality inventories in pilot selection program. *Educational and Psychological Measurement, 7*, 735-744.

Sutker, P. B., & Allain, A. N. (1995). Psychological assessment of aviators captured in World War II. *Psychological Assessment, 7*(1), 66-68.

Sutter, E. L., Townsend, J. C., & Ornstein, G. N. (1954). The light plane as a pre-primary selection and training device II: Analysis of training data. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Sutton, D. G. (1930). Psychology in Aviation. *U.S. Naval Medical Bulletin, 28*, 5-13.

Symonds, C. J., Rejman, M. H., & Shepherd, E. W. *Prediction of success from training*. Paper presented at the Aircraft Accidents: Trends in Aerospace Medical Investigation Techniques Conference.

Tate, J. P. (1998). *The Army and Its Air Corps: Army Policy Toward Aviation, 1919-1941*. Maxwell Air Force Base, Alabama: Air University Press.

'The Army and Its Air Corps' was James P. Tate's doctoral dissertation at Indiana University in 1976. During the past 22 years, Tate's remarkable work has gained wide acceptance among scholars for its authoritative and well-documented treatment of the formative years of what eventually became the United States Air Force. Thoroughly researched but bearing its scholarship lightly, Tate's narrative moves swiftly as it describes the ambitions, the frustrations, and the excruciatingly slow march to final success that never deterred the early airmen. 'The Army and Its Air Corps' is one in a series of airpower history classics that the Air University Press is pleased to bring before a wider audience.

Taylor, C. W., Murray, S. L., Ellison, R. L., & Majesty, M. S. (1971). Development of motivation assessment techniques for Air Force officer training and education programs: Motivation for pilot training. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

The authors attempted to develop a motivational screening device that would reduce the number of voluntary eliminees from undergraduate pilot training (UPT) and to develop an instrument which could be used to measure changes in motivation as subjects progress through pilot training (and later on the job). Both an a priori and an empirical keying approach were used to develop measures intended to predict several different types of attrition. Two hundred twenty-four self initiated eliminees (SIE) from UPT identified their reasons for attriting and these were subsequently examined to develop subcategories (i.e., criterion measures) that could be used to classify eliminees (e.g., SIE, flying deficiency, medical elimination, etc.). The initial item pool for predictor battery development contained 2500 items, 899 of which were included in the first version of the battery. The predictor battery consisted of two biographical inventories (BIs) with

approximately 300 items each and an Activities Index, which was a 300 item personality test. The battery was administered to all active students in the Officer training School (OTS), which was operated at Lackland AFB between January and November 1970. Of the a priori scales, only the BI creativity key demonstrated predictive validity with total attrition (r = -. 10, p < .05). All other validities for a priori BI keys and for all of the other criteria were non-significant. Of the a priori personality scales, Abasement, Change, Energy, Science, Sensuality, Audacity and Motivation all demonstrated marginal negative validity for several of the attrition measures (generally on the order of -. 10 to -. 16). The validities for the Harm Avoidance scale ranged from .09 (ns) for elimination due to flying deficiency to .18 (p < .01) for UPTIOTS-SIE. Supplication also correlated positively with attrition, although the validity coefficients were generally small. The empirically derived scales resulted in moderately large validity coefficients (generally in the .20s and -30s) for almost all the attrition criteria, except for elimination due to flying deficiency. They also correlated significantly with self-rated lack of dedication to complete UPT (correlations ranged from .38 @ < .01) for flying deficiency to .72 @ < .01) for UPT/OTS-SIE). Generally, the a priori scales only accounted for a small proportion of attrition variance. Significantly more positive results were obtained using the empirically developed scales.

Taylor, E. K., & Parker, J. W. (1959). Spatial tests as predictors of success in Air Force training. Lackland Air Force Base, TX: Wright Air Development Center.

Taylor, H. L. (2004). *Technical Review Summary Report: Selection Instrument for Flight Training (SIFT)*. U.S. Army Research Institute for the Behavioral and Social Sciences. Arlington, VA.

Taylor, J. L., & Arizigian, S. (1970). Officer personnel costs: Pilots and Naval flight officers procured through AVROC and OCS programs. Washington, DC: Naval Personnel Research and Development Laboratory.

Taylor, J. L., O'Hara, R., Mumenthaler, M. S., & Yesavage, J. A. (2000). Relationship of CogScreen-AE to Flight Simulator Performance and Pilot Age. *Aviation, Space, and Environmental Medicine, 71*(4), 373-380.

Frasca simulator, age 50-69, correlated factors with performance, speed/working memory correlates most with overall flight performance, age improved prediction, motor performance not age dependent.

Telfer, R. (Ed.). (1993). *Aviation Training and Instruction*. Aldershot, Hampshire: Gower Ashgate.

Temme, L. A., Ricks, E., Morris, A., & Sherry, D. (1991). Visual contrast sensitivity of U.S. Navy jet pilots. *Aviation, Space, and Environmental Medicine, 62*(11), 1032-1036.

Good visual contrast sensitivity (CS) is often described as a visual capability important for success as a military aviator and so has been suggested as a physical standard for personnel selection and retention. To evaluate this idea, we measured the CS of 135 U.S. Navy fighter pilots ranging in age from 24 to 44 years (mean = 30.20, S.D. = 4.06) and compared these to the CS of non-aviators. We obtained the non-aviator data from published studies of other investigators who used similar procedures with the same widely used, commercially available

apparatus (Nicolet CST 2000). In addition to this comparison, we correlated the pilots' CS with their air-to-air target detection distances measured during air combat maneuver training and to their night carrier landing performance scores. The major findings were: 1) The mean CS of the aviators and the non-aviators were within +/- 1.0 S.D. of each other in most instances, and those few instances where a greater difference was found were parsimoniously explained by methodological and procedural factors; 2) sensitivities to different spatial frequencies were highly correlated among themselves, indicating much redundancy among the measurements; 3) there was no evidence of a relationship between CS and air-to-air target detection distances or night carrier landing performance.

Temme, L. A., Still, D. L., & Fatcheric, A. J. (1995). Jet pilot, helicopter pilot, and college student: a comparison of central vision. *Aviation, Space, and Environmental Medicine, 66*(4), 297-302.

Jet pilots (JP) (N = 44), helicopter pilots (HP) (N = 29), and college students (CS) (N = 41) were tested with a battery of vision tests designed to assess vision skills important for success as a naval aviator. Tests included measures of reaction time, high-contrast acuity, low-contrast acuity, spot detection, far-to-near gaze shift, near-to-far gaze shift, low-contrast acuity with glare, and dark focus. A Multivariate Analysis of Variance (MANOVA) compared the vision test performance of the three subject groups (JP, HP, and CS). Only with the Far-to-Near test was there no difference among the three groups. On all other tests, JP outperformed CS. The difference between HP and CS was less consistent and less dramatic than the difference between JP and CS. Only with the glare test were CS significantly better than HP. The results were interpreted as reflecting the influence of various selection factors, operational requirements, differential attrition, and age.

Terman, L. M. (1918). The use of intelligence tests in the Army. *Psychological Bulletin, 15*(203-206).

Terman, L. M. (1919). The measurement and utilization of brain power in the Army. *Science, 49*(221-226, 251-259).

Tham, M. P. (1996). *The visual attention battery: Predicting flight performance with visual attention tasks.* 57, ProQuest Information & Learning. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=1996-95019-066&site=ehost-live

Thomas, H. (2003). An overview of the ADF Electronic Psychology Record System. *Australian Journal of Psychology, 55*, 147-147.

Thomas, J. G., Owen, D. B., & Gunst, R. F. (1977). Improving the use of educational tests as selection tools. *Journal of Educational Statistics, 2*(1), 55-77.

Thompson, W. T. (2005). U.S. military unmanned aerial vehicle mishaps: Assessment of the role of human factors using Human Factors Analysis and Classification System (HFACS). Brooks City-Base, TX: U.S. Air Force 311the Performance Enhancement Directorate.

Thompson, W. T., Orme, D. R., & Zazeckis, T. M. (2004). Neuropsychological Evaluation of Aviators: Need for Aviation-Specific Norms? Brooks City-Base, TX: USAF School of Aerospace Medicine.

To determine medical qualification to fly, aviators who sustain head trauma or acquire other conditions that effect mental skills must undergo neuropsychological evaluations. A challenge for psychologists tasked with performing these evaluations is that conventional neuropsychological tests are characteristically normed using samples reflecting the general population. It would be more appropriate to compare aviators with a sample of their peers. The present paper demonstrates the importance and usefulness of aviator-specific psychometric norms. To do this, normative tables were developed from a large sample of United States Air Force pilot training candidates using the Multidimensional Aptitude Battery, a standardized intelligence test. Psychologists may find these tables useful when evaluating aviators.

Thorndike, E. L. (1919). Scientific personnel work in the army. *Science, 49*, 53-63.

Thorndike, E. L. (1919). A standardized group examination of intelligence independent of language. *Journal of Applied Psychology, 3*(1), 13-32.

Develops a non-verbal intelligence test similar to the Beta examination of the army. Four types of tests used in the Beta test were included, along with four additional tests. Describes the material, the instructions given by the examiner, and the administration and scoring procedures of the tests. Discusses the significance of the examination score for a candidate who takes it without any previous acquaintance as compared to one who is already familiar with the two tests. Emphasizes the practical advantages of such tests.

Thorndike, E. L. (1920). The selection of military aviators. *U.S. Air Service, 1 and 2*.

Thorndike, R. L. (Ed.). (1947). *Research problems and techniques. Report No. 3*. Washington, DC: U.S. Government Printing Office.

Thorndike, R. L. (1949). *Personnel selection; test and measurement techniques*. New York,: J. Wiley.

Thorndike, R. L. (1956). Development and applications of tests of special abilities. *Review of Educational Research, 26*(1), 14-25.

Thorndike, R. L., & Hagen, E. P. (1958). Long-term prediction of some officer-effectiveness measures from aptitude tests. Lackland Air Force Base, TX: Personnel Laboratory.

Tice, S. N., & James, E. J. (2005). The Aviator. *Journal of Feminist Family Therapy, 17*(1), 72-74.

Reviews the Martin Scorse movie, The Aviator. Emphasizes fear as a motivator for Howard Hughes' acquisition of power.

Tirre, W. C. (1997). Steps toward an improved pilot selection battery. In R. Dillon (Ed.), *Handbook on Testing* (pp. 220-255). Westport, CT: Greenwood Press.

Tirre, W. C. (1998). *Crew Selection for Uninhabited Air Vehicles: Preliminary Investigation of the Air Vehicle Operator (AVO)*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society, Chicago, IL.

Because of the similarity of the AVO console to a desktop flight simulator, a preliminary idea of what aptitude factors would predict success in AVO training might be obtained through a validation study using a desktop flight simulator as the criterion task. In this study, 171 young men and women learned to fly a simulated light aircraft. The participants also took a comprehensive g-hour battery of computer-based tests. Results indicated that learning was predicted well by general cognitive ability (g)/ working memory (WM) and multilimb coordination. When structural equation modeling was used to distinguish declarative and procedural learning, declarative learning was found to be strongly dependent on g/WM, which is consistent with previous research. That g/WM did not correlate with procedural learning explains why correlations of this ability with learning diminished as instruction moved from a declarative to procedural emphasis. Only multilimb coordination ability was strongly related to procedural learning.

Tirre, W. C., & Raouf, K. K. (1998). Structural models of cognitive and perceptualmotor abilities. *Personality and Individual Differences, 24*(5), 603-614.

A collection of 25 computer-administered tests was given to a sample of 172 adults to examine the overlap between the cognitive and perceptual-motor abilities domains. The focus was on multilimb coordination ability as a criterion variable, as this ability has a long history of validity in predicting pilot training performance. Structural equation modeling was used to test two related models of human abilities. The first one being a causal model and the second being a nested hierarchical model. The results suggest that multilimb coordination ability is not simply another manifestation of general cognitive ability, but instead the result of several abilities such as dynamic visual processing, visuo-spatial processing and working memory. A second narrower perceptual-motor factor, target tracking, was found to be related to processing speed but no other cognitive factor.

Tomlinson, H. (1954). Development of short alternatives for a valid classification test. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Two 4-part chart reading tests and two 3-part dial-reading tests were studied for the efficiency with which they predicted scores obtained on the Dial and Table Reading test. Predictions from combination of 2 or 3 chart-reading subtests were better than those obtained from the dial-reading tests and were almost as efficient as were all 8 parts of the 2 chart-reading tests. Sets of 2 or 3 chart-reading subtests, requiring 2 minutes of testing time for each subtest are equivalent in predictive power to the Dial and Table Reading test.

Tomlinson, H., & Elson, J. E. (1962). Abtracts of personnel research reports: II. 1958-1961. Lackland AFB: 6570th Personnel Research Laboratory, Aerospace Medical Division, Air Force Systems Command.

Abstracts are assembled of 126 technical documentary reports issued by the Air Force's personnel research laboratory from January 1958 through December 1961. They cover research projects in selection, classification, and utilization of Air Force personnel. The reports are indexed by personal author, corporate author, and project number.

Toquam, J. L., McHenrry, J. J., Corpe, V. A., Rose, S. R., Lammlein, S. E., Kemery, E., . . . Bosshardt, M. J. (1988). Development and field test of behaviorally anchored rating scales for nine MOS. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The research described in this report was performed under Project A, the U.S. Army's current, large-scale, manpower and personnel effort to improve the election, classification, and utilization of Army enlisted personnel. This report documents the development and field test of behaviorally anchored rating scales for nine Military Occupational Specialties (MOS). These include combat, combat support, and noncombat MOS. For each MOS, the behavioral analysis method was used to generate examples of performance. These examples were used to identify performance effectiveness dimensions and to develop behavioral definitions of performance for each dimension. Across the nine MOS, behavioral summary rating scales contained from 7 to 13 performance dimensions. The nine sets of MOS-specific behavioral summary rating scales were field tested in continental United States and overseas locations in two groupings (Batch A and Batch B). For each MOS, ratings scales were administered to 120 to 160 first-term soldiers and their supervisors. Within each MOS, interrater reliability estimates for individual performance dimension ratings were reasonably high and rating distributions were acceptable, indicating no leniency or severity effects. Results from the field tests, along with suggestions from proponent review committees and Project A staff, were used to modify and prepare the nine sets of rating scales for the Concurrent Validation study.

Torjussen, T. M., & Hansen, I. (1999). Forsvaret, best i test? Bruk av psykologiske tester i forsvaret, med spesiell vekt pÃ¥ flygerseleksjon. *Tidsskrift for Norsk Psykologforening, 36*(8), 772-779.

Torrance, E. P. (1954). The development of a preliminary life experiences inventory for the study of fighter intercept pilot effectiveness. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Torrance, E. P., & Ziller, R. C. (1957). Risk and life experience: Development of a scale for measuring risk-taking tendencies. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Toulmin, J. A., Jr. (1927). *Air Service American Expeditionary Force 1918*. Nashville: Battery Press.

Townsend, G. A. (1866). *Campaigns of a Non-Combatant, and His Romaunt Abroad During the Civil War*. New York: Blelock & Company.

Trekler, J. T. (1969). The relationship of ego identity to success in Naval aviation training. Norfolk, VA: Antisubmarine Warfare, Task Group Delta, Human Factors Group.

Trites, D. K. (1954). Psychiatric screening of flying personnel: Research on the Personnel Inventory Test. Brooks Air Force Base, TX: U.S. Air Force School of Aviation Medicine.

Trites, D. K., & Kubala, A. L., Jr. (1957). Characteristics of successful pilots. *Journal of*

Aviation Medicine, 28, 34-40.

Determining the characteristics of successful military pilots requires two types of assessments of individuals . First, it is necessary to define and measure their personal characteristics and, second, it is necessary to array them on some continuum of success. These two operations can represent either a concurrent or a longitudinal undertaking. In the concurrent approach, both the degree of success and the personal characteristics are evaluated at more or less the same time. This has the advantage of representing the current interaction of a subject 's attributes and the extent of his success. It is also less expensive in terms of the number of subjects required to obtain samples of a specified size. It suffers from the disadvantage that no information can be obtained concerning the association between success and personal characteristics over time. In other words, since measurement of an individual's personal characteristics may be directly influenced by the extent of his success at the time of measurement, no inferences concerning the predictability of success by personal characteristics are warranted.

Trites, D. K., Kubala, A. L., Jr., & Sells, S. B. (1954). *Operational aircraft accidents subsequent to training as a function of personal characteristics of pilots and students*. Paper presented at the Southeastern Psychological Association Meeting.

Trites, D. R., Holtzman, W. H., Templeton, R. C., & Sells, S. B. (1953). Psychiatric screening of flying personnel: Research on the SAM Sentence Completion Test. Randolph Field, TX: USAF School of Aviation Medicine.

This report describes research on the development of the SAM Sentence Completion Test, "What Is He Saying?" whit was part of the Randolph Field Battery of experimental psychiatric selection tests developed and r this project. The test form a given in Repair No. 1 (34), with instructions for its administration. The experimental design of the program for the development of psychiatric screening devices for flying personnel is described in Reports Nos. 1 and 2 (3 , 35). The Sentence Completion Test is a projective technique of personality study. A projective device is an ambiguous eat situation which is designed to encourage the subject to invest the stimulus materials with hi own wishes, impulses, fantasies, and values -in other words, to "project" certain aspects of his personality into the test response. Somewhat like the word-association method, the subjects are presented with stimuli consisting of one or m re words representing incomplete sentences . The task of the subject is to complete each sentence . The SAM Sentence Completion Test was structured to evoke responses indicative of attitudes and feelings related to motivation for military flying, self-esteem , interpersonal relations, and conformity o social customs . These factors are described in port No. 1 as important factors in predisposition to psychiatric failure.

Trumbull, R., Melton, R. S., & Hollander, E. P. (1954). Changes in personality characteristics of Naval aviator cadets: I. Indoctrination week to completion of pre-flight. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Tsang, P. S., & Vidulich, M. A. (Eds.). (2003). *Principles and practice of aviation psychology*. Mahwah, N.J.: Lawrence Erlbaum.

Tucker, G. J., & Reinhart, R. F. (1966). Psychomotor functions, the body image, and aviation.

Pensacola , FL: Naval Aerospace Medical Institute.

Tucker, H., Brattin, L., & Reason, W. (2002). Revised Anthropometric Restrictions for U.S. Navy and Marine Corps Trainer and Fixed-Wing Nonejection Aircraft and U.S. Coast Guard HU-25. NAWCADPAX/TR-2002/103. Patuxent River, MD: Naval Air Warfare Center.

Tucker, J. A. (1954). Use of previous flying experience as a predictor variable. Lackland Air Force Base, TX: U.S. Air Force Personnel and Training Research Center.

Tupes, E. C. (1953). The validity of the Aviation Cadet-Officer Candidate Qualifying Test AXA and AXB for prediction of success in USAF Officer Candidate School. Lackland Air Force Base, TX: U.S. Air Force Human Resources Research Center.

Tupes, E. C. (1955). Comparison of performance in USAF officer candidate school of candidates selected by two screening procedures. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Selection procedures for OCS were changed early in 1952, and this report compares results of selection by the revised procedures with selection by those previously used. The existence of a backlog of applicants who had been accepted under the old procedures made it possible to study and OCS class containing reasonably large samples of candidates selected by both methods. The two crucial changes were elimination of college credit requirements and removal of the subjective ratings by past military supervisors. The general effect was to render the bases of officer candidate selection more objective, placing a floor under general aptitude requirements and improving the estimation of past military accomplishments. A greater percentage of the group selected under the new procedures graduated from OCS, and a significantly higher percentage ranked high in the class. Failures for military deficiency were in the same proportion for both groups, but the new selection procedures resulted in higher academic success.

Tupes, E. C. (1957). Relationships between behavior trait ratings by peers and later officer performance of USAF Officer Candidate School graduates. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Tupes, E. C. (1959). Personality traits related to effectiveness of junior and senior Air Force officers. Lackland Air Force Base, TX: Wright Air Development Center.

Tupes, E. C. (1960). Estimating AFOQT officer quality stanines from general aptitude index. Lackland AFB, TX: Personnel WWRDP-TM-60-15Laboratory.

Tupes, E. C. (1960). Recurrent personality factors based on trait ratings by peers; their validity for prediction and evaluation; and their measurement for selection purposes. Washington, DC: Office of Naval Research.

Tupes, E. C., & Borg, W. R. (1955). Evaluation of a selection composite for screening applicants for USAF Officer Candidate School. Lackland Air Force Base, TX: Air Force Personnel

and Training Research Center.

Procedures for screening and selecting applicants for USAF Officer Candidate School (OCS) were modified early in 1952. The new composite score consisted of an officer quality score derived from the Aviation Cadet Qualifying Test (ACQT), a score based on board interview, and other scores awarded for years of college completed, airman technical schools completed, airman rank, and length of service, weighted according to their presumed importance to success in OCS and to later officer performance. Scores on the composite and its components were obtained for OCS Class 53-B. Biserial correlations between these scores and the criterion of graduation did not differ significantly from zero. Only the ACQT officer quality score was significantly related to academic grades. 4 variables were significantly related to military grades (service, rank, and interview positively, and college negatively). Further analysis suggested that modified weighting of the components could improve the prediction of both criteria.

Tupes, E. C., Bowles, J. W., & Torr, D. V. (1955). Predicting motivation for flying training among senior AFROTC cadets. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Tupes, E. C., Carp, A., & Borg, W. R. (1957). Validation of a proposed officer effectiveness selection battery. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Tupes, E. C., & Christal, R. C. (1958). Stability of personnel trait rating factors obtained under diverse conditions. Lackland Air Force Base, TX: Wright Air Development Center.

Tupes, E. C., & Christal, R. E. (1957). Psychological tests and the selection and classification of Air Force officers. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

This report is a nontechnical review of the research programs with a listing of 75 scientific publications produced by Air Force personnel research in this area. Contributions of psychological tests to officer selection for flying training and technical training are summarized. 5 graphic figures illustrate the efficiency of tests in selection. The directions in which current research is moving are indicated. Aptitude tests are generally used in officer selection programs but are not yet fully exploited in officer classification.

Tupes, E. C., & Kaplan, M. N. (1961). Relationships between personality traits, physical proficiency, and cadet effectiveness reports of the Air Force Academy. Lackland Air Force Base, TX: Air Force Systems Command.

Tupes, E. C., & Madden, H. L. (1968). Prediction of officer performance and retention from selected characteristics of college attended. Lackland AFB, TX: Air Force Human Resources Laboratory.

Tupes, E. C., & Yarnold, J. K. (1952). Military attitude as a predictor of Air Force success: Preliminary studies of the attitude survey. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Turnbull, G. J. (1992). A review of military pilot selection. *Aviation, Space, and Environmental Medicine, 63*(9), 825-830.

The author reviews the various methods that have been used to select pilots over the years. This comprehensive review begins with a description of the "selection" method used by the Wright brothers in 191 3 (i.e., they flipped a coin) to decide who would fly their plane and includes the present-day multivariate approach to selecting pilots. He describes the historical depiction of pilots as sportsmen with initiative and humor, as well as high-spirited, gregarious and lacking in imagination. The RAF developed the first basic aptitude tests used to select pilots during WWI, but these efforts receded after the war ended. However, by 1941 the high incidence of failure in RAF pilot training became a major problem and the focus on pilot selection once again increased. This cycle is contrasted against the remarkable success of the German Luftwaffe selection procedures. The Germans used a combination of psychological and aptitude testing and were very successful in selecting pilots. The author reviews the use of personality tests in general and concludes that they have had some success in predicting pilot training performance, but that their susceptibility to faking is a major failing. The use of "objective" tests (e.g., the Rod and Frame test) is also reviewed. He concludes that while there is no one reliable way to select pilots, there is considerable evidence suggesting that the measurement of the "right stuff' is feasible.

Turney, M. A. (2004). *Tapping Diverse Talent in Aviation: Culture, Gender, and Diversity*. Aldershot, Hampshire, England ; Burlington, VT, USA: Ashgate.

Tuttle, A. D. (1941). Physiological and psychological characteristics of successful pilots. *Military Surgeon, 88*, 227-237.

U.S. Department of War. (1916). *War Department Annual Reports, 1916, Vol I*. Washington, DC: U.S. Government Printing Office.

Uhlaner, J. E. (1971). Psychological testing in the military services. In L. C. Deighton (Ed.), *Testing special groups: The armed forces*. New York: MacMillan.

Uhlaner, J. E. (1977). The Research Psychologist in the Army--1917 to 1977. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The report presents an abbreviated account of developments in military psychology in the Army, beginning with the general ability tests developed and used in World War 1. A chronological listing of "Events and Organizational Change" is accompanied by interpretive comment in terms or "Research Achievements and Directions." The following periods are treated: Beginning, 1917 to 1921, Interim Period, 1921to I939, World War II, 1939-1945, Early Post-War Years, 1945 to 1951, Period of Transition, 1951 to 1960, Developments, 1960 to 1969, and 1969 to the Present.

Ullrich, W. F. (2008). A History of Simulation: Part II-Early Days. *Modeling, Simulation and Training,* 27-28.

United States. (1971). Master control. 209 (RU 5-2 [Aug. 1971]). *AFRTS Collection* [sound recording]. Los Angeles: American Forces Radio and Television Service.

An interview with Dr. Dora Strawder and a discussion of aviation psychology.

United States Army Air Forces. (1947). Aviation psychology program research reports (pp. v.). Washington, D.C.,: U.S. Govt. print. off.

USAAVNC Evaluation Team. (1979). Evaluation of the 175/40 Initial Entry Rotary Wing flight training program. Volume I: Executive Summary. Pensacola, FL: Seville Research Corp. This report presents results of an evaluation of the Army's 17 5/40 Initial Entry Rotary Wing (IERW) training program. The program consists of 175 flight and 40 simulator hours. In the last training phase of the program, students are divided into two training tracks, i.e., Utility Helicopter and Aeroscout. Data were gathered from IERW training files and through questionnaires administered to instructors at the Army Aviation Center and to unit instructors, supervisors, and program graduates at aviation field units world-wide. Data were gathered on graduates of both the 175/40 program and the 180/20 program that preceded it, and comparisons between the two programs are made. Results and conclusions are presented with reference to nine specific evaluation objectives. Major conclusions are: (1) the 175/40 IERW course is accomplishing its objectives; (2) the 175/40 course is an improvement over the 180/20 course; and (3) proficiency progression and individualized training can play an effective role in IERW training.

USAAVNC Evaluation Team. (1979). Evaluation of the 175/40 Initial Entry Rotary Wing flight training program. Volume II: Evaluation Report. Pensacola, FL: Seville Research Corp. This report presents results of an evaluation of the Army' s 175/40 Initial Entry Rotary Wing (IERW) training program. The program consists of 175 flight and 40 simulator hours. In the last training phase of the program, students are divided into two training tracks, i.e. , Utility Helicopter and Aeroscout. Data were gathered from IERW training files and through questionnaires administered to instructors at the Army Aviation Center and to unit instructors, supervisors, and program graduates at aviation field units world-wide. Data were gathered on graduates of both the 175/40 program and the 180/20 program that preceded it, and comparisons between the two programs are made. Results and conclusions are presented with reference to nine specific evaluation objectives. Major conclusions are: (1) the 175/40 IERW course is accomplishing its' objectives; (2) the 175/40 course is an improvement over the 180/20 course; and (3) proficiency progression and individualized training can play an effective role in IERW training.

Valentine, E. S., & Tomlinson, F. L. (1902). *Travels in Space: A History of Aerial Navigation*. London: Hurst and Blackett, Limited.

Valentine, L. D. (1960). A factor-analytic study of the USAF officer activity inventory. Lackland Air Force Base, TX: Wright Air Development Division.

Valentine, L. D. (1961). Air Force Academy selection variables as predictors of success in pilot training. Lackland AFB, TX: Personnel Laboratory.

Valentine, L. D. (1961). Development of the Air Force Precommission Screening Test-62. Lackland AFB, TX: Personnel Laboratory.

Valentine, L. D. (1961). Percentage of navigator applicants qualifying under various selection criteria. Lackland AFB, TX: Personnel Laboratory.

Valentine, L. D. (1977). Navigator-observer selection research: Development of a new Air Force Officer Qualifying Test navigator-technical composite. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Valentine, L. D., & Creager, J. A. (1961). Officer selection and classification tests: Their development and use. Lackland AFB, TX: Personnel Laboratory.

Valentine, L. D., & McGrevy, D. (1972). *Validation of a pilot psychomotor selection battery*. Paper presented at the 14th Annual Military Testing Association Conference, Lake Geneva, WI.

The purpose of this paper is to present initial findings on utility of two psychomotor tests for improved selection of Air Force pilots. During, and for a few years following World War II, the predecessor organization of the Air Force Human Resources Laboratory conducted an extensive program of psychomotor research, and selected psychomotor tests developed under this program were an integral part of the World War II Aircrew Classification Batteries. Much of this early effort has been described by Melton (1947). Generally, it was found that such assessments had validity for predicting eliminations from pilot training beyond that achieved with a battery of paper and pencil tests. Use of psychomotor assessments in the Air Force pilot selection testing program was discontinue in the early 1950‘s because of the expense and difficulty of maintaining and calibrating the required equipment under decentralized testing conditions.

Van Wagenen, M. J. (1919). *Some Results and Inferences Derived From the Use of the Army Tests at the University of Minnesota*. Paper presented at the Annual Meeting of the American Association for the Advancement of Science, Saint Louis, MO.

During the two academic years 1917-18 and 1918-19 the Army Test Alpha or its equivalent, Form E, was given to the freshman classes of nearly all the colleges at the University of Minnesota In some of the colleges the results were used as an aid in diagnosing the causes of student failures. In other colleges the purpose was purely an experimental one. The use of the tests has revealed some significant information regarding the students of the various colleges. For instance, over eighty per cent of the student body of the University as a whole were found to come from the upper fifteen to twenty per cent of the population in general. With the exception of two of the individual tests the women of the several colleges did just as well or even better than the men of the same colleges, but in these two tests—the range of information test and the arithmetic problems test—from seventy to seventy-five per cent of the men did as well or better than the median woman. Making correction for the excess of overlapping due to the use of a single test, from sixty-five to seventy per cent of the men may be expected to do as well or better in solving arithmetic problems and to have as wide or a wider range of the kind of information called for m the Army Tests than has the median woman of the same college.

Van Wyen, A. O. (1969). *Naval aviation in world war I*. Washington, DC: Chief of Naval Operations.

Vandyke, G. A. (1981). *The personality research form (PRF) as a prediction for success in pilot training*. Paper presented at the 23rd Annual Military Testing Association Conference, Arlington, VA.

This study examined the utility of Jackson‘s Personality Research Form (PRF) in the selection of aircrew in the Canadian Forces. A total of 1962 male candidates completed either the English or French version of Form E. Major findings focused on the validity scales, anglophone versus francophone differences on the 22 scales and the predictive validity of the scales against performance in flying training. Results show that while Infrequency scores are within the range reported by Jackson, the Desirability scores obtained were very high. There are also some significant correlations between Desirability scores and scores on other trait scales. There were a number of differences between performance of anglophone and francophone subjects and these will be discussed, together with other early stage psychometric evaluations of the Form. Finally, the PRF may prove useful in the counseling of candidates who are interested in becoming military pilots.

Vann, J. W. (1937). To what extent is reality adjustment concerned in the selection of flying trainees? *U.S. Naval Medical Bulletin, 35*, 434-440.

Varney, A. (1950). *The psychology of flight*. New York,: Van Nostrand.

Veaudry, W. (1973). *U.S. Army pilot assessment center project*. Paper presented at the 15th Annual Military Testing Association Conference, San Antonio, TX.

Veaudry, W. F. (1973). *U.S. Army pilot [first attempt] assessment center project*. Paper presented at the 15th Annual Military Testing Association Conference, San Antonio, TX.

Velis, D. N. (2005). Proposal for electroencephalogram standardization in aircrew selection. *Epilepsy & Behavior, 6*(1), 27-30.

Current diagnostic electroencephalogram (EEG) investigations in aircrew selection and certification lack both standardization and reference to universally applicable criteria for their effective use. Extrapolation from clinical EEG studies may not be appropriate. Recent studies on serial EEGs in aircrew are lacking, whereas follow-up of individuals who failed certification is nonexistent. Population-based EEG studies in healthy subjects are generally underpowered to establish the significance of pathological EEG findings. Advanced digital video/EEG recording, in combination with standardization of data exchange formats and automated detection of pathological grapho-elements, is cost effective when carried out for extended periods, e.g., during flight simulator sessions. Extensive databases of serial video/EEG records in aircrew may thus be easily obtained and validated over time. Prognostic inferences on the significance of pathological EEG discharges may subsequently be derived from these databases.

Verdone, R. D., Sipes, W. E., & Miles, R. (1993). Current trends in the usage of the adaptability rating for military aviation (ARMA) among USAF flight surgeons. *Aviation, Space, and Environmental Medicine, 64*(12), 1086-1993.

The Adaptability Rating for Military Aviation (ARMA) is that portion of the initial flight physical that assesses an aviator candidate's motivation for and potential adaptability toward an aviation career. A survey was mailed to all USAF operational flight surgeons in the continental

U.S. to describe the frequency and distribution of ARMA usage and attitudes. Descriptive statistics suggest that the ARMA is used suboptimally in accordance with current USAF regulation. ARMA training, flight surgeon satisfaction and lack of regulation clarity are described and discussed. More flight surgeons are dissatisfied with the ARMA than are satisfied, and the regulation is perceived as unclear in the area of final disposition for candidates with equivocal ARMA's. A post-hoc analysis to rule out the influences of rank, gender, experience and residency training was performed. Residency training in Aerospace Medicine is beneficial in terms of doing an ARMA, when required, and covering recommended areas. Females and those with less than 1 year experience perform an ARMA more frequently than males and experienced flight surgeons. Despite the limitations of the current ARMA, it should not be abandoned. Recommendations to improve it are provided. Doing better ARMA's can lead to decreased illness, injury, accidents, and attrition.

Vernon, P. E., & Parry, J. B. (1949). *Personnel Selection in the British Forces*. London: University of London Press.

Viteles, M. S. (1942). An historical introduction to aviation psychology: Civil Aeronautics Administration, Division of Research.

Viteles, M. S. (1945). The Aircraft Pilot: 5 Years of Research. A summary of outcomes. *Psychological Bulletin, 42*(8), 489-526.

Committee on Selection and Training of Aircraft Pilots In 1939 the Civil Aeronautics Authority (now the Civil Aeronautics Administration) undertook an ambitious program of training civilian pilots. The purpose of this was to make young men and young women air-minded and to prepare the present generation of young people to fly the private and commercial planes of the future. This program, known as the Civilian Pilot Training program, was operated through the universities of the country, making use of already established facilities in the hands of private operators while encouraging others to set up similar facilities. The first phase of the Civilian Pilot Training program called for instruction of 10,000 pilots, which was quickly expanded to the number of 50,000. Almost simultaneously with the formulation of the program, largely through the efforts of Robert Hinckley, at that time Chairman of the Civil Aeronautics Authority and Dean R. Brimhall , Director of Research, funds were set aside for research on selection and training of civilian aircraft pilots. This was done in the belief that an extended program of civilian pilot training should make use of every possible scientific aid for selecting those most competent to fly; for determining the best methods of training; for the appraisal of flight achievement, and for safe-guarding the adjustment of the pilot. Moreover, it was recognized that this large scale training program provided unusual opportunities for renewing the study of problems related to the human side of aviation which had been initiated during World War I and abandoned almost immediately with the signing of the Armistice.

Viteles, M. S. (1945). Research in aviation psychology. *Transactions of the New York Academy of Science, 7*, 220-235.

Voas, R. B. (1957). Inventory testing of vocational interests of Naval aviation cadets: Final results. Pensacola, FL: Naval Aerospace Medical Institute, Naval Aerospace Medical Research Laboratory.

Voas, R. B. (1959). Vocational interests of naval aviation cadets: Final results. *Journal of Applied Psychology, 43*, 70-73.

This study attempts to determine whether interest patterns, as measured by the Kuder Preference Record (KPR), differ between students who successfully complete flight training and those who do not. The KPR is a standard interest inventory that consists of nine scales: Mechanical, Computational, Scientific, Persuasive, Artistic, Literacy, Musical, Social Service and Clerical. This was a follow-up study for work completed by Rosenberg and Izard (1954), which found that students who failed flight training scored lower on the Mechanical and Scientific scales and higher on the Persuasive, Literacy and Musical scales than did those students who passed flight training. Six hundred and five aviation cadets participated: 465 who successfully completed training, 74 who withdrew at their own request and 66 who failed at some point during flight training or were eliminated for medicaVphysica1 reasons. The author constructed an empirically keyed Voluntary Withdrawal (VW) scale based on results from Rosenberg and Izard. For those scales that differentiated successful cadets from unsuccessful cadets, a score of " 1" was assigned to those items that unsuccessful cadets endorsed and a score of "0" was assigned to those items that successful cadets endorsed. A high score on the VW scale indicated a pattern of interests similar to cadets who had failed flight training. Results of this study showed that of the nine KPR scales, significant differences between successful and unsuccessful cadets were only found for the Mechanical and Scientific scales. In addition, the cadets who voluntarily withdrew from training scored significantly higher on the VW scale than cadets who succeeded, although there was quite a bit of shrinkage in the cross validity sample (r = .56 compared to r = .17). When scores on the Mechanical Comprehension Test were held constant, the differences between the successful and unsuccessful cadets on the VW scale became nonsignificant. Thus, the validity of the VW scale was apparently based mostly on its relationship to mechanical ability.

Voas, R. B., Bair, J. T., & Ambler, R. K. (1954). Validity of personality inventories in the Naval aviation selection program. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Voas, R. B., Bair, J. T., & Ambler, R. K. (1955). The relationship between behavior in a stress situation and later separation from flight training with expressed anxiety toward flying. Naval Air Station Pensacola, FL: U. S. Naval School of Aviation Medicine.

Voas, R. B., Bair, J. T., & Ambler, R. K. (1956). Relationship between behavior in a stress situation and later separation from flight training with expressed anxiety toward flying. *Psychological Reports, 2*, 393-397.

This study examines the effects of stress tolerance on a purified success in training criterion. Subjects were 1540 flight trainees who were participating in decompression chamber classes. Stress tolerance was operationalized as whether or not subjects replaced their air mask during a chamber ride or experienced ear blocks. Flight training criteria included poor performance leading to failure in training or voluntary withdrawal, and an indication of "anxiety toward flying" (assessed in an unstructured exit interview). Subjects were classified into one of three groups at the end of training: (1) "S" group were those who successfully completed training; (2) "P" group were those who failed (this group was subsequently divided into "PA" – poor performance with anxiety and "PN" - poor performance without anxiety); and (3) "M"

group made up of all subjects who did not complete training for various other reasons. Results indicated that those subjects who demonstrated anxiety in the chamber ride were more likely to demonstrate anxiety during flight training, that is, the S group demonstrated considerably less anxiety than the P group during the chamber ride. In addition, the PN group demonstrated less anxiety than did the PA group. Also, the PN group did not differ from either the S or M groups in level of anxiety.

Voas, R. B., Bair, J. T., & Ambler, R. K. (1956). Some evidence for the concurrent validity of the Heineman Anxiety Scale. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Vrisakis, N. S. (2001). *Prediction of performance in Australian Defense Force basic flying training*. Paper presented at the 43rd Annual International Military Testing Association Conference, Canberra, Australia.

In January 1999 Australian Defence Force Basic Flying Training School (ADF BFTS) was formed at Tamworth, NSW. The unit‘ s role is to conduct Ab Initio flying training for ADF pilots. This study examined preliminary results of ADF BFTS courses to validate selection procedures for the new ADF flying training system. Predictor variables included flight screening scores, previous flying experience (PFE), student age and aptitude test scores. Full data was available for 80 students from courses ADF1-ADF5 who underwent the Flight Screening Programme (FSP). Data was collected from the pilot selection database maintained by Central Pilot Selection Agency (CPSA). Chi Square analysis was used to examine the association between predictor variables and Failure for Air Work Rates (FAW) in Basic Flying Training. In accordance with earlier research, this study showed that the FSP is a valid predictor of performance in military flying training. Similarly there was a significant relationship between PFE and performance at BFTS. Aptitude test scores and student age were not related to performance at BFTS. Range restriction may have affected the analysis of aptitude test scores. Recommendations from the study include: that the FSP be maintained as one of a number of techniques used to select pilots for the ADF; and that aptitude test scores (via Pilot Index) continue to be used as a method of selecting prospective flight screening candidates. Future research will examine the validity of current selection procedures for the full continuum of military flying training.

Waag, W. L., Shannon, R. H., & Ambler, R. K. (1973). The Use of Confidential Instructor Ratings for the Prediction of Success in Naval Undergraduate Pilot Training. Naval Air Station, Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Waag, W. L., Shannon, R. H., Ambler, R. K., & Baisden, A. G. (1973). A factor analytic study of attritions from naval aviation training. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Waag, W. L., Shannon, R. H., Ambler, R. K., & Baisden, A. G. (1973). A survey of attritions from the pilot/NFO flight training programs. Pensacola, FL: Naval Aerospace Medical Research Laboratory.

Waddell, R. W. (1970). Selection and utilization of test pilots in the United States Army. Maxwell Air Force Base, AL: Air Command and Staff College.

Wagner, R. F. (1951). Development of standardized procedures for defining the requirements of aircrew jobs in terms of testable traits: USAF School of Aviation Medicine.

Wahl, E. J. (1998). *An Analysis of Aviation Test Scores to Characterize Student Naval Aviator Disqualification.* MS, Naval Postgraduate School, Monterey, CA.

Wahlberg, J. L., Boyles, W. R., & Boyd, H. A. (1971). Peer ratings as predictors of success in military aviation. Alexandria, VA: Human Resources Research Organization.

Three experimental peer rating forms were developed for use in research in prediction of the aviation training performance criterion--completion/attrition--from the training program for Aviation Warrant Officer Candidates at the U.S. Army Helicopter School. This paper describes the construction of the ratings, the "Potential Aviator Mating" forms, and compares the validity of these forms with the Contemporary Evaluation Form (CEF) used b the U.S. Army Helicopter School. The basic comparison involved validity between absolute scale and ranks. The original validity coefficients were sufficiently high to anticipate that the use of peer ratings may increase predictive accuracy in a multivariate system.

Walker, F. (1902). *Aerial Navigation: A practical handbook on the construction of dirigible balloons, aerostats, aeroplanes, and aeromotors*. London: Crosby Lockwood and Son.

Walker, N. K., & Walker, M. M. (1979). Dual-task performance (ZITS/ADT) tests on ANG and USAF pilots and a comparison with results of cockpit simulator tests with dive bombing and strafing results. Rockville, MD: Norman K. Walker Associates, Inc.

Wallace, S. (2001, February). America West Airlines: New focus in Phoenix. *Airline Pilot Careers, 6,* 18-22.

Wallon, E. J. (1956). A study of Rosenzweig scoring patterns among Naval aviation cadets. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Walters, B. A., Huber, S., French, J., & Barnes, M. J. (2002). Using simulation models to analyze the effects of crew size and crew fatigue on the control of tactical unmanned aerial vehicles (TUAVs) (pp. 35). Aberdeen Proving Ground, MD: U.A. Army Research Laboratory.

This report describes a study conducted by Micro Analysis and Design, Inc., for the U.S. Army Research Laboratory (ARL). One area of research examined by ARL was the staffing required to operate tactical unmanned aerial vehicles (TUAVs). The primary objective of the study was to use simulation modeling to analyze how fatigue, crew size, and rotation schedule affect operator workload and performance during the control of a TUAV. Computer simulation models were developed with the Micro Saint Discrete Event Simulation software to simulate the tasks that operators perform when controlling a TUAV. These models, which contain system-specific attributes of the Shadow 2001 TUAV, included a fatigue function to predict performance effects for day and night missions. Subject matter experts (SMEs) provided the list of tasks involved in controlling a TUAV (during normal operations and emergencies), the order of these tasks, and the visual, auditory, cognitive, and psychomotor workload values associated with each

task. Twelve different crew configurations were examined for the tactical operations center (TOC) and the launch and recovery station (LRS), which ranged in size from 8 to 15 crew members. The conclusions from executing the models and interviewing SMEs (during 12- and 18-hour missions) indicate that reducing the number of aerial vehicle operators (AVOs) and mission payload operators (MPOs) in the TOC can result in more aerial vehicle mishaps during emergencies, increased search time, and a decreased number of targets detected. For example, compared to six AVOs or MPOs in the TOC, the addition of two crew members resulted in only slight performance gains of a 6% increase in target detection and a 4% decrease in target search time. However, when the members of the crew were reduced to four AVOs or MPOs in the TOC, there was substantial performance loss (20% decrease in target detection and a 15% increase in target search time). The general conclusion is that a crew of 12 (TOC [two MCs and six AVOs or MPOs]; LRS [two MCs and two AVOs]) is the most efficient trade-off between performance and crew size. The implications of these findings for other possible crew configurations are discussed, along with plans for further analyses.

Walters, L. C., Miller, M. R., & Ree, M. J. (1993). Structured Interviews for Pilot Selection: No Incremental Validity. *International Journal of Aviation Psychology, 3*(1), 25-38.
Investigates the structured interviews for U.S. Air Force pilots. List of subject attributes for the interview; Types of predictors in the interview; Validity of the interviews.

Want, R. L. (1962). The validity of tests in the selection of Air Force pilots. *Australian Journal of Psychology, 14*(2), 133-139.

War Department Office of the Adjutant General. (1917). *Unit equipment manual for the aviation section, signal corps*. Washington, DC: U.S. Government Printing Office.

Warner, J. D., & Knapp, B. G. (2000). Crew characteristics for common ground station applications (pp. 40). Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.
The purpose of this study was to determine the required skill set for common ground station of the future (CGS-future) and compare it to the present military occupational specialty (MOS) 96H skill requirements in order to determine the appropriateness of the 96H for operating the CGS-future. We approached the objectives by conducting subject matter expert and documentation reviews of presently accepted training for MOSs 96H, 96D, and 96B; by employing the Job Assessment Software System (JASS) in order to assess what skills and abilities are needed for what duty and at what demand; and by creating a dynamic task-network performance model to simulate work flow and error rate during different operating conditions. Results indicated that there is skill shift (higher levels of analytical skills required) for the operator of the CGS-future. These skill demands are at a level similar to or higher than those required by MOSs 96D and 96B. However, a simple substitution of the more analytically trained MOSs (96B and 96D) is not the solution, since the training cost to learn CGS skills exceeds the cost to enhance current training. The cost-effective approach would be to determine what 96B and 96D skills and how much of them must be integrated into the 96H training. Furthermore, the complex relationship of the training to successful performance, especially under different mission demands, is not validated. Further use of the dynamic model to develop a body of data derived from careful manipulation of personnel mixes and mission requirements could provide valuable advice to decision makers who track these complex issues.

Warnick, W. L. (1972). Combat job requirements for the air cavalry aeroscout pilot and aeroscout observer. Alexandria, VA: Human Resources Research Organization.

Waters, B. K., Edwards, B. J., & Smith, B. A. (1978). Multimedia cognitive pretraining of Air Force pilots. *Educational Technology, 18(3)*, 50-58.

Waters, L. K. (1964). The relationships among the needs and values of flight candidates. Pensacola, FL: Naval School of Aviation Medicine.

Waters, L. K., & Wherry, R. J. (1959). A factor analysis of aptitude and achievement tests and performance in the Naval air training program. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Waters, L. K., & Wherry, R. J. (1959). Factor analysis of selection Lists and performance measures in the U.S. Naval School, pre-flight. Pensacola, FL: Naval Aerospace Medical Institute, Naval Aerospace Medical Research Laboratory.

Waters, L. K., & Wherry, R. J. (1961). Predicting voluntary withdrawal from flight training by means of a forced-choice scale: Construction and preliminary validation. Pensacola, FL: Naval School of Aviation Medicine.

Watson, J. B. (1919). *Psychology From the Standpoint of a Behaviorist*. Philadelphia: J.B. Lippincott.

Watson, S. E., & Walker, R. F. (1998). *The basic research UAV task environment (BRUTE)*. Paper presented at the 42nd Annual Meeting of the Human Factors and Ergonomics Society.

This demonstration features a PC-based Synthetic Task Environment (STE) developed by the United States Air Force (USAF) to investigate Uninhabited Air Vehicle (UAV) operations. UAVs are remotely operated airplanes, and are typically used for aerial reconnaissance tasks. The goals for the development of this UAV-STE were that it should: 1. Capture key aspects of UAV operations 2. Allow rapid configuration into existing and conceptualized UAV systems 3. Flexibly incorporate experimental manipulation and data collection 4. Avoid exotic hardware/software reconfiguration requirements.

Watson, W. J., & Goody, K. (1975). Matching job education requirements with candidate educational attainment: A pilot methodological study. Lackland Air Force Base, TX: Air Force Human Resources Laboratory.

Webb, W. B. (1955). Grades in training and subsequent accidents. Naval Air Station Pensacola, FL: U.S. Naval School of Aviation Medicine.

Webb, W. B. (1955). The prediction of flight accidents from training accidents. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Webb, W. B., Bair, J., & Ambler, R. K. (1954). Attrition data as a criterion: I. Reason for withdrawal and flight performance. Pensacola, FL: U.S. Navy School of Aviation Medicine.

Webb, W. B., & Nelson, W. H. (1953). The prediction of aircraft accidents by instructors: Preliminary findings. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Webb, W. B., & Nelson, W. H. (1954). Instructor ratings of students involved in accidents: Spins and stalls. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Weeks, J. L. (2000). Unmanned aerial vehicle operator qualifications. Mesa, AZ: Air Force Research Laboratories.
UAV

Weeks, J. L. (2000). USAF Pilot Selection. . Mesa, AZ: Air Force Research Laboratory.

Weeks, J. L., & Zelenski, W. E. (1998). Entry to USAF Undergraduate Flying Training. Brooks AFB, TX: United States Air Force Research Laboratory.

Weibull, & Martensson, L. (1991). The right stuff in the wrong system? In E. Farmer (Ed.), *Stress and Error in Aviation* (Vol. 2, pp. 143-149). Aldershot: Avebury Technical.

Weissmuller, J. (2006). *Personality and mission effectiveness*. Paper presented at the 48th International Military Testing Association Conference, Kingston, Ontario, Canada. http://www.icodap.org/061004/
In support of our Air Staff initiatives, we in the Military Testing Section (Ken Schwartz, Chief, USAF Military Testing and I) have spent the last two months working to revitalize the USAF personnel research program for strategic force management issues. This has consumed a large portion of our attention up through 4:00 PM on Saturday, September 30th, the last day of our fiscal year. I am happy to report that we were successfully in launching four major –general personnel research" contracts totally nearly two million dollars from unexpected fallout funds. In one of these contracts there is a task to evaluate the effectiveness and potential for using the new Self Description Inventory (SDI+) which has become part of the Air Force Officer Qualifying Test (AFOQT) since August 2005. We now have nearly 10,000 AFOQT answer sheets which represent not only current USAF Officers, but also –applicants" in the sense that they entered the commissioning source, but may not have progressed through final commissioning. This dataset will be an invaluable asset in our first, near-term plans for evaluating personality measures in any future operational Air Force personnel program.

Weissmuller, J. J., Schwartz, K. L., Kenney, S. D., Shore, C. W., & Gould, R. B. (2004). *Recent Developments in USAF Officer Testing and Selection*. Paper presented at the 46th International Military Testing Association Conference, Brussels.
Military testing in the United States Air Force (USAF) falls into several categories. Testing associated with Education & Training is vital for preparing a team-oriented, a mission-ready force. The other forms of testing, collectively known as Personnel Tests, have a direct impact on defining an individual's official job and level of responsibility. The goal of personnel

testing is to select, promote, or certify the most qualified individuals. The Air Force Personnel Center at Randolph AFB (HQ AFPC) is charged with managing this force throughout the world to ensure the right person is at the right place at the right time. For this reason, all military personnel tests are centrally managed by the Air Force Military Testing Section of AFPC. The Air Force Military Testing Section (AFPC/DPPPWT) is responsible for the integrity and application of personnel tests that are used across the Air Force. This section performs many functions related to testing including 1) recommending new research/validation needs, 2) evaluating emerging test technologies; 3) managing test development contracts, 4) validating proposed instruments against professional standards, 5) applying accepted psychometric procedures in response to non-standard testing situations, 6) interpreting, reviewing, and updating Air Force testing policy instructions, 7) responding to inquiries and requests for waivers, 8) coordinating the Test Control Officer network, 9) providing oversight and coordination for testing and associated study materials printing and distribution operations, 10) receiving and scanning completed test answer sheets, and 11) scoring, uploading, and answering routine inquiries on all test results. Because many of these tests will affect the quality of people in the Air Force (as well as a person‘s pay), AFPC/DPPPWT is a key player in combating test compromise, including support for detection, statistical analysis, and prosecution, working in close concert with the Air Force Office of Special Investigations (AFOSI) and the Test Development Flight of the Air Force Occupational Measurement Squadron (AFOMS/TE) and the AFOMS Commander.

Weitzman, R. A. (1983). Racial bias and predictive validity in testing for selection. Monterey, CA: Naval Postgraguate School.

Weybrew, B. B., & Youniss, R. P. (1957). The Personal Inventory Barometer (PIB): I. Development of the questionnaire. New London, CT: U.S. Naval Medical Research Laboratory.

Wheat, G. S. (1920). *Municipal Landing Fields and Air Ports*. New York: G.P. Putnam's Sons.

Wheeler, J. (2002). *Redeveloping the selection process for the Royal Australian Air Force Officer applicants*. Paper presented at the 44th Annual International Military Testing Association Conference, Ottawa, ON, Canada.

The Officer Interview Board (OIB) is the final stage in the selection process for applicants applying for Officer level positions in the Royal Australian Air Force (RAAF). Concerns were raised about the validity of the OIB in the selection of Officer applicants, including; limited standardisation between OIBs, high rejection rate of applicants, and the potential for the selection criteria assessed at the OIB to have become outdated. This study examined the OIB, in the context of the entire RAAF Officer selection system, to identify areas that could be refined and/or redeveloped. The study aimed to develop a selection system that was current, streamlined, standardised and a valid predictor of future training and job performance. A job analysis was conducted to determine the essential attributes of entry-level RAAF Officers, and subsequently identified nine attributes deemed essential to assess in the selection system. An examination of the RAAF Officer selection system revealed that a number of the essential attributes were not being assessed. In addition, it was maintained that some of the essential attributes could be assessed through assessment techniques other than an interview format. It was

proposed that the OIB be redeveloped into an assessment-centre style Selection Board to assess the essential attributes of RAAF Officer applicants. This paper describes the development and final design of the RAAF Officer Selection Board. Future directions for the validation of the Selection Board will also be discussed.

Wherry, R. J., & Hutchins, C. W. (1964). An investigation of unpredicted differences in attrition rates among students from different procurement sources. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Whitely, S. E., & Dawis, R. V. (1972). A model for psychometrically distinguishing aptitude from ability. Arlington, VA: Office of Naval Research.

It is now widely agreed that current ability measures reflect a complex interaction of environment with genetic potential. This leads to a basic measurement problem since persons with the same measured ability may vary widely in potential due to non-equivalent learning opportunities. The purpose of this paper is to present a model which may hold some promise in psychometrically distinguishing ability (current status) from aptitude (potential). Data on a simple ability are analyzed according to the model to illustrate how some of the practical problems may be solved.

Whiteside. (2002). A synopsis of the Vienna Test System: A computer aided psychological diagnosis. *Journal of Occupational psychology, Employment, and Disability, 5*(1), 43-50.

This paper aims to provide a brief synopsis of the Vienna Test System based on a short demonstration tape containing some 50 or so exercises, including sub-divisions, described as computer aided psychological diagnosis. It is intended not as a specific test review, but as a helpful guide to those interested in accessing a particular test from this extensive battery. It should be noted that only a brief introduction to many of the tests is possible as the demonstration tape only gives shortened samples of content and minimal normative data in terms of comparison groups.

Whitmarsh, A. (2007). British Army manoevres and the development of military aviation, 1910-1913. *War in History, 14*(3), 325-346.

Historians have generally considered that the British army dismissed the potential value of aircraft prior to the First World War, only realizing the implications of military aviation after its outbreak. Before 1914, however, many senior British army officers had begun to understand that air power would soon change the nature of warfare. They had reached this under- standing as a result of demonstrations by aircraft during many of the manoeuvres and other training exercises carried out in the years 1910–13.

Wichman, H., & Ball, J. (1983). Locus of control, self-serving biases, and attitudes towards safety in general aviation pilots. *Aviation, Space, and Environmental Medicine, 54*, 507-510.

Wickens, C. D., Mountford, S. J., & Schreiner, W. (1980). Task dependent differences and individual differences in dual-task performance. New Orleans, LA: Naval Biodynamics Laboratory.

The methodological issues involved in demonstrating the existence of a time-sharing

ability are outlined. A survey of relevant experimental literature indicates that, while there is some evidence for a task specific time-sharing ability, there appears to be little for a more general "A-factor" of attention of dual task performance ability. An experiment is then described in which 40 subjects performed 4 tasks singly and in various pairwise combinations. The tasks, tracking, spatial judgments, digit classification and auditory memory, were selected to systematically load different stages of information processing. The patterns of task interference observed, conformed to predictions of structure specific capacity theories of attention, with structures defined by processing stages, processing modalities and cerebral hemispheres. Confirming previous research, little evidence was provided for a "general" time-sharing ability. More specific abilities were however suggested by the data to relate to visual scanning, and automation of auditory memory store.

Wickens, C. D., & Pierce, B. (1978). Attentional resource allocation in a variable difficulty dual task paradigm. Washington, DC: Air Force Office of Scientific Research.

A model of the attention allocation process in a dynamic environment with changing task demands was presented. The model describes the manner in which optimal and sub-optimal allocation of resources can be revealed by linear coherence analysis of the dual task performance and difficulty measures, and partitions the allocation process into subprocesses of performance demand evaluation and subsequent resource allocation. Eight subjects time-shared two compensatory tracking tasks under conditions of constant task difficulty, and under conditions when the difficulty (percent acceleration dynamics) of one task was varied over the course of the trial. Subjects were instructed to maintain constant performance on the variable difficulty task, and augmented performance feedback was presented on half of the trials. The data were evaluated in terms of the model, and coherence and error analysis revealed that allocation was far from optimal. The failure of augmented feedback to improve the optimality of allocation suggested that the limitation lay within the allocation, rather than the demand evaluation process. Some reasons were proposed for these limitations, and for the contrast of the current results with optimum allocation observed in constant difficulty dual task studies.

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Wiener, S. (2002). *Military Flight Aptitude Tests* (6 ed.): Thomson Peterson's.

Wiggins, M. W., & Stevens, C. (1999). *Aviation Social Science: Research Methods in Practice*. Aldershot, Hants, England ; Brookfield, Vt., USA: Ashgate.

Williams, A. C. (1971). *Discrimination and manipulation in goal-directed instrument flight*. Urbana,: Engineering Publications Office.

Williams, A. C., & National Research Council (U.S.). Committee on Selection and Training of Aircraft Pilots. (1940). *Automatic recording of muscular tension during flight*. Washington, D.C.: Committee on Selection and Training of Aircraft Pilots, Division of Anthropology and Psychology, National Research Council.

Williams, E. S., & Greenston, P. M. (2006). Pilot Study to examine training eligibility standards.

Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

The aim of this pilot study is to examine training enlistment standards utilizing Army Training Requirements and Resources System (ATRRS) training data which records individual-level training events for all MOS, but is limited to pass / fail outcomes. Specifically, we seek to investigate the tradeoffs between training eligibility and Advanced Individual Training (AIT) completion brought about through lowering / raising minimum enlistment training standards, and to develop methodologies which can be utilized to assist school proponents in assessing the appropriateness of their Aptitude Area (AA) cut scores. For the initial effort in this pilot, the 50 MOS investigated belonged to a handful of school proponents who expressed an interest in the objectives of this study, plus a few additional ones recommended by Army Accessions Command. Subsequently, an additional 30 MOS that promised sufficient numbers of (failure) observations were also included. The authors specify and estimate binary logistic regression models of pass / fail training outcomes over the 2001 – 2004 period. Training outcome is estimated as a function of AA governing composite, Soldier demographic, and component membership variables. The estimated models are then applied to the larger Army enlisted contract population to examine the policy tradeoffs. For select MOS, the policy analyses are examined more closely using risk analysis simulation methods.

Williams, G. O. (1940). Flying aptitude tests. London, England: Flying Personnel Research Committee, Royal Air Force, Ministry of Defense.

Williams, H. P., Albert, A. O., & Blower, D. J. (1999). *Selection of officers for U.S. naval aviation*. Paper presented at the Workshop of the Research and Technology Organization Human Factors and Medicine Panel (HFM) Meeting 55, Officer Selection (RTO-MP-55), Monterey, CA.

This paper reviews the process of selecting officers for U.S. naval aviation training and describes one of the principal selection tools, the Aviation Selection Test Battery (ASTB). The 1992 version of the ASTB is a paper-and-pencil test administered to all applicants for naval aviation training. ASTB scores and ground school and flight training performance data were available for 2852 student naval aviators and student naval flight officers, and these data were used to re-assess the validity of the ASTB in predicting student performance. The results indicated that the ASTB remains a valid predictor of ground school and flight training grades, and to a lesser extent, attrition from training. For a small subset of the sample used in these analyses, data from a computer-based performance test (CBPT) were also available. The CBPT required subjects to engage in multi-axis tracking tasks concurrently with other cognitive tasks, such as dichotic listening and working memory tasks. Scores from the ASTB, the CBPT, and grades from ground school were entered into a linear regression upon primary flight training grades. The results showed that the combination of ground school and CBPT scores can be used as a good predictor of performance ($R2 = .33$, $p < .0001$). Although these results will require cross validation, the CBPT shows promise as a new selection tool. The importance of these results is discussed in the context of a recently developed computer-based version of the ASTB.

Williams, H. P., Albert, A. O., & Blower, D. J. (2000). *Selection of officers for U.S. naval aviation training*. Paper presented at the North Atlantic Treaty Organization, Research and Technology Organization Meeting Proceedings No. 55, Neuilly-sur-Seine, France.

Williams, H. S., & Williams, E. H. (1915). *Modern Warfare*. New York: Hearst's International Library Co.

Williams, K. W. (2007). Unmanned aircraft pilot medical certification requirements. Oklahoma City, OK: Civil Aerospace Medical Institute, Federal Aviation Administration.
This research study was undertaken to create recommendations for unmanned aircraft pilot medical certification requirements. The effort consisted of the convening of a panel of subject matter experts and interactions with groups engaged in the process of establishing unmanned aircraft pilot guidelines. The results of this effort were a recommendation and justification for use of the second-class medical certification.

Williams, L. J. (1995). Peripheral Target Recognition and Visual Field Narrowing in Aviators and Nonaviators. *International Journal of Aviation Psychology, 5*(2), 215-232.
Examines accuracy of peripheral target recognition and visual field narrowing among aviators and nonaviators. Observation of larger effective functional visual fields among aviators; Susceptibility of nonaviators to visual field narrowing; Effect of load increases on aviator performance. Examines accuracy of peripheral target recognition and visual field narrowing among aviators and nonaviators. Observation of larger effective functional visual fields among aviators; Susceptibility of nonaviators to visual field narrowing; Effect of load increases on aviator performance.

Williams, M. J., & Kamman, J. F. (1946). Personnel deficiencies responsible for unsuccessful aerial combat missions. *American Psychologist, 1*, 294.

Willingham, W. W. (1958). A note on peer nominations as a predictor of success in naval flight training. Pensacola, FL: Naval School of Aviation Medicine.

Willingham, W. W. (1958). The relation of age to succession in flight training. *Journal of Aviation Medicine, 29*, 136-138.

Willingham, W. W., & Ambler, R. K. (1962). Comparison of methods for deriving peer nomination scores. Pensacola, FL: U.S. Naval School of Aviation Medicine.

Wilmer, W. H. (1920). Aviation Medicine in the A.E.F. Washington, D.C.: War Department, Director of Air Service.

Wilson, C. L. (Ed.). (1959). *Project Mercury candidate evaluation program. WADC-TR-59-505*. Wright-Patterson Air Force Base: Wright Air Development Center.

Wilson, D. R., & Fallshore, M. (2001). *Optimistic and ability biases in pilots' decisions of risk regarding FVR flight into IMC*. Paper presented at the 11th International Symposium on Aviation Psychology, Columbus, OH.

Wise, J. A., V. D. Hopkin, V. D., & Garland, D. J. (Eds.). (2010). *Handbook of Aviation Human Factors* (2nd ed.). New York: CRC Press.

Wiskoff, M. F., & Rampton, G. M. (Eds.). (1989). *Military Personnel Measurement: Testing, Assignment, Evaluation*. New York: Praeger.

Wiskoff, M. F., & Sands, M. M. (1983). *Military personnel testing: Past, present, and future*. Paper presented at the 25th Annual Military Testing Association Conference, Gulf Shores, AL.

From the enormous early task of classifying thousands of personnel into military assignments under the pressure of World War I, to today's state-of-the-art work in computerized testing, military research has been at the forefront of personnel testing. This paper will review some current research developments, including a recent cross-national comparison of testing methods, and reflect on future research directions.

Wong, J. (2005, Fall). SynWin Version 1.2. *Ergonomics in Design, 13,* 30-32.

Woodhouse, H. (1917). *Textbook of Naval Aeronautics*. New York: The Century Co.

Woodhouse, H. (1920). *Textbook of Aerial Laws and Regulations for Aerial Navigation, International, National and Municipal, Civil and Military*. New York: Frederick A. Stokes Co.

Worthington, B. (1993). *Pilot selection procedures since the enactment of the Americans with disabilities act of 1990*. Paper presented at the 7th International Symposium on Aviation Psychology, Columbus, OH.

Ways in which the Americans with Disabilities Act (ADA) effects selection procedures for professional pilots are examined on the basis of responses to a questionnaire filled out by 104 companies with 25 or more employees who hire pilots with commercial or air transport pilot licenses. It is found that most aviation companies see themselves in compliance with ADA. The compliance did not require a great deal of time, effort or money. Most companies surveyed had to make some changes in the pilot selection procedures; the biggest changes were in the areas of the medical examination and the pilot application form. (AIAA)

Woycheshin, D. (2001). Analysis of Canadian Automated Pilot Selection System (CAPSS) results. Ottawa, ON: Chief of Air Staff.

Woycheshin, D. (2001). Relationships between paper and pencil tests, CAPSS results and Primary Flying Training results. Ottawa, ON: Chief of Air Staff.

Woycheshin, D. (2001). Validation of the Canadian Automated Pilot Selection System (CAPSS) against primary flying training results. Ottawa, ON: Chief of Air Staff.

Woycheshin, D. (2002). Validation of the Aircrew Test Series. Ottawa, ON: Chief of Air Staff.

Woychesin, D. E. (1999). *CAPSS: The Canadian automated pilot selection system*. Paper presented at the Workshop of the Research and Technology Organization Human Factors and Medicine Panel (HFM) Meeting 55, Officer Selection (RTO-MP-55), Monterey, CA.

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Xiao, W., Miao, D., Wang, J., Liu, X., Luo, Z., Liu, P., . . . Liu, F. (2002). Psychological selection of pilots in civil aviation with the Uchida-Kraepelin test. *Chinese Mental Health Journal, 16*(4), 249-251.

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Yerkes, R. M. (1919). Report of the psychology committee of the National Research Council. *Psychological Review, 26*(2), 83-149.

Yerkes, R. M. (Ed.). (1920). *The New World of Science: It's Development During the War*. New York: The Century Company.

Yerkes, R. M. (Ed.). (1921). *Psychological Examining in the United States Army* (Vol. XV). Washington, DC: Government Printing Office.

Yoakum, C. S., & Yerkes, R. M. (Eds.). (1920). *Army Mental Tests*. New York: Henry Hollt and Company.

Young, W. Y. (2002). Update of U.S. Army Research Institute's Officer Personnel Research Data Bases for 1999 and 2000. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Youngling, E. W., Levine, S. H., Mocharnuk, J. B., & Weston, L. M. (1977). Feasibility study to predict combat effectiveness for selected military roles: fighter pilot effectiveness. East St Louis, MO: McDonnell Douglas Astronautics Co.

This study focuses upon enhancing the U.S. record of air-to-air combat kills through more stringent and comprehensive selection procedures. Specifically, it presents empirical evidence which demonstrates that a program can be developed to select pilots who will be effective in air-to-air combat. Developing such a selection program involves a job analysis of the fighter pilot task, the generation of testable trait hypotheses, the development of predictor variables and peacetime and combat criteria, and validation and cross validation during peacetime and during combat. Forty-five factors were identified only 10 of which are adequately evaluated within a current U.S. military selection program upon initial entrance into pilot training. Assessment of the 35 untapped factors is within technological reach; in fact, many of these factors can be assessed by tests which are presently available.

Youngling, E. W., Levine, S. H., Mocharnuk, J. B., & Weston, L. M. (1977). *Notes on the feasibility of predicting fighter pilot effectiveness*. Paper presented at the 19th Annual Military Testing Association Conference, San Antonio, TX.

History has demonstrated that there is a pressing need for improved selection and training of fighter pilots. In World War II. only one of twenty pilots became an ace. The U.S. Air Force kill ratio in Southeast Asia was approximately 2.5 to 1. In contrast, the Israelis claim to have had

a kill ratio of 60 to 1. Our feasibility study has focused upon enhancing our record of air-to-dir Combat kills through more stringent and comprehensive selection procedures. Evidence is presented which demonstrates that a program can be developed to select pilots who will be effective in air-to-air Combat. From reviews of U.S. and foreign selection research dating from World War II to the present and the assessment of pilot opinion from hundreds of aces, 45 factors were identified as potential predictors of fighter pilot combat effectiveness. Of these 45 factors, only 10 are adequately evaluated within current military selection programs upon entrance into pilot training. Assessment of the remaining 35 untapped factors is within our technological reach. In fact, many of these factors can be assessed by tests which are presently available. We developed an Air Combat Effectiveness Study (ACES) program which would establish selection test measures for virtually all of the factors identified as underlying fighter pilot combat effectiveness. As part of the ACES program, selection test measures would be validated against performance in air combat maneuvering ranges, thereby providing a method for selecting fighter pilots during peacetime. We have emphasized selection for success in the operational environment rather than success in training. Armed with these selection test scores and an effectively executed validation program, researchers should, for the first time in history, be able to specify a definitive profile of the ace fighter pilot.

Youtz, R. P. (1946). Objective measures of flying skill for the first 20 hours of Army pilot training. *American Psychologist, 1*, 294.

Zaccaria, L., & Cox, J. A. (1947). Differential validity of the Aircrew Classification Battery (February 1947) for assignment to basic pilot training. Lackland Air Force Base, TX: U.S. Air Force Human Resources Research Center.

Zaccaria, L., & Cox, J. A. (1952). Comparison of aviation cadets and student officers in primary pilot training. Lackland Air Force Base, TX: USAF Human Resources Research Center.

Zaccaria, M. A., Dailey, J. T., Tupes, E. C., Stafford, A. R., Lawrence, H. G., & Ailsworth, K. A. (1956). Development of an interview procedure for USAF officer applicants. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center.

Zachert, V., and Friedman, G. (1953). The stability of the factorial pattern of aircrew classification tests in four analyses. *Psychometrika, 18*(3), 219-224.

This study consists of four factor analyses of the Army Air Forces Aircrew Classification Batteries. The first was an analysis of the 1945 wartime battery, while the other three were analyses of the 1947 postwar battery, consisting of essentially the same variables, but using different samples. Eleven factors were found which had been identified and reported in previous analyses. An additional factor, possibly an artifact, was identified as an age-education doublet. The only factor which differed significantly in the analyses was pilot or flying interest. These factor analyses show that the factorial content of the tests remains quite similar in both wartime and postwar populations. The data reported in this study were collected as part of the United States Air Force Human Resources Research and Development Program and described in Research Bulletin 52-16. The opinions or conclusions contained in this report are those of the authors. They are not to be construed as reflecting the view or indorsement of the Department of the Air Force.

Zachert, V., & Friedman, G. (1952). Factorial comparisons of two aircrew classification batteries with and without the variable of previous flying experience. Lackland Air Force Base, TX: U.S. Air Force Human Resources Research Center.

Zachert, V., & Shibe, E. (1951). Analysis of principles, organization, and classification for optimum selection and classification. Lackland AFB, TX: Human Resources Research Center.

Zedeck, S., Tziner, A., & Middlestadt, S. E. (1983). Interviewer validity and reliability: An individual analysis approach. *Personnel Psychology, 36*, 355-370.

Zeidner, J., & Drucker, A. J. (1988). *Behavioral Science in the Army: A Corporate History of the Army Research Institute*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences

Zeidner, J., Goldstein, L. G., Sprunger, J. A., & Karcher, E. K. (1956). Evaluation of fixed wing selection tests for predicting success in Army helicopter pilot training: U. S. Army Adjutant General's Personnel Research Branch.

Zeidner, J., Johnson, C., Vladimirsky, Y., & Weldon, S. (2002). Determining Composite Validity Coefficients for Army Jobs and Job Families (pp. 181). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Zeidner, J., Johnson, C., Vladimirsky, Y., & Weldon, S. (2003). Determining Mean Predicted Performance for Army Job Families. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Zeidner, J., Martinek, H., & Anderson, A. A. (1958). Evaluation of experimental predictors for selecting Army helicopter pilot trainees: II.: U. S. Army Adjutant General's Personnel Research Branch.

Zeidner, J., Martinek, H., & Klieger, W. A. (1958). Analysis of flight evaluations of Army helicopter pilot trainees: U. S. Army Adjutant General's Personnel Research Branch.

Zeidner, J., Martinek, R., & Anderson, A. A. (1958). Evaluation of experimental predictors for selecting Army helicopter pilot trainees: I: U. S. Army Adjutant General's Personnel Research Branch.

Zeidner, J., Van Steenberg, N. J., & Anderson, A. A. (1958). Prediction of success in the Army Cargo Helicopter Pilot course. Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences.

Ziebel, T. S. (1989). *Policy issues for Air Force personnel testing programs*. Paper presented at the 31st Annual Military Testing Association Conference, San Antonio, TX.
The Air Force Military Personnel Center (AFMPC) has been the office of primary

responsibility (OPR) for Air Force personnel testing programs since 1970. As the OPR, we are responsible for the development of plans, policies, and procedures necessary to monitor and implement all Air Force personnel testing programs. Whenever a new personnel test is implemented, AFMPC must establish the policies and procedures necessary for proper test administration and control of the data. Therefore, we are intimately involved in the planning and operational implementation of the Basic Attributes Test (BAT) which will be used as a selection and classification tool in the new Pilot Selection and Classification System (PSACS). Our role as the policy-maker will be to establish all testing requirements for the BAT under the Air Force test control system. We will provide guidance and regulate procedures for test administration, security of the test data, retest policy, and a variety of other issues.

Zifkin, B. G. (2005). The electroencephalogram as a screening tool in pilot applicants. *Epilepsy & Behavior, 6*(1), 17-20.

The electroencephalogram (EEG) is used to screen pilot candidates for professional licensure irrespective of medical history in many European countries; applicants with paroxysmal abnormalities are excluded. The aim is to reduce the risk of later seizures in flight, which may cause accident or death, but there is no clear evidence that EEG screening can lead to any significant risk reduction. This is partly due to the low predictive value of the EEG, the low risk of seizure in healthy young adults, and the low risk of commercial aircraft accidents. Later-onset seizures, unrelated to the results of earlier screening, cannot be predicted or prevented by screening. Some benefit cannot be excluded, but may be difficult to demonstrate in prospective studies. Specialized screening of targeted populations, such as for photosensitivity in helicopter pilot candidates, may be justifiable; prospective studies with standardized recording and interpretation protocols are needed to assess this.

Zuliani, R. A. (1983). *Sex differences in aircrew selection*. Paper presented at the 25th Annual Military Testing Association Conference, Gulf Shores, AL.